This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

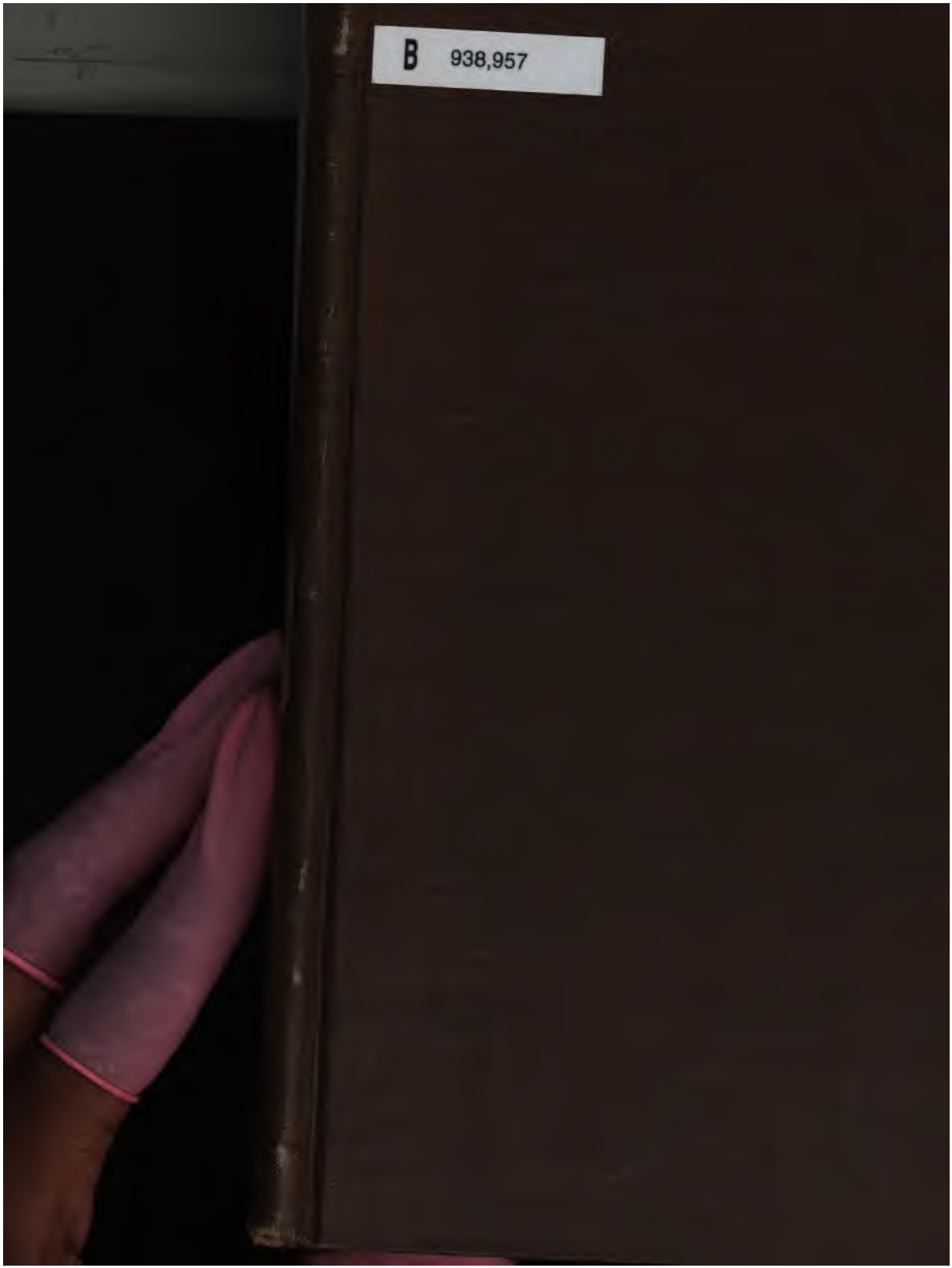
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

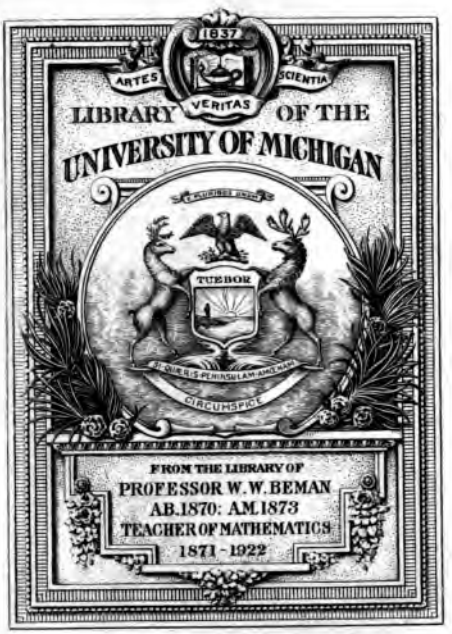
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`


B 938,957


1837
ARTES
VERITAS
SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
TUEBOR
CIRCUMSPICE
FROM THE LIBRARY OF
PROFESSOR W. W. BEMAN
A.B. 1870: A.M. 1873
TEACHER OF MATHEMATICS
1871 - 1922

Q
155
.W68
1802
v. 1

Stgreaves

THE

MATHEMATICAL AND PHILOSOPHICAL

WORKS

OF THE

RIGHT REV. JOHN WILKINS,

LATE LORD BISHOP OF CHESTER.

TO WHICH IS PREFIXED

THE AUTHOR's LIFE,

AND

AN ACCOUNT OF HIS WORKS.

IN TWO VOLUMES.

VOL. I.

CONTAINING,

I. The Discovery of a New World: or, a Discourse tending to prove, that it is probable there may be another Habitable World in the Moon. With a Discourse of the Possibility of a Passage thither.
II. That it is probable our Earth is one of the Planets.

LONDON:
PRINTED BY C. WHITTINGHAM,
Dean Street, Fetter Lane,
FOR VERNOR AND HOOD, POULTRY; CUTHELL, AND MARTIN, MIDDLE-ROW, HOLBORN; AND J. WALKER, PATERNOSTER-ROW.

1802.

THE

LIFE OF THE AUTHOR:

AND AN

ACCOUNT OF HIS WRITINGS.

HE was son to Walter Wilkins, citizen and goldsmith of Oxford; was born at Fawlsly, near Daventry, in Northamptonshire, in the house of the reverend and well known Mr. John Dod, who wrote upon the commandments, he being his grandfather by the mother's side. He was taught his Latin and Greek by Edward Sylvester, a noted Grecian, who kept a private school in the parish of All Saints in Oxford: his proficiency was such, that at thirteen years of age he entered a student in New-Inn, in Easter-term, 1627. He made no long stay there, but was removed to Magdalen-Hall, under the tuition of Mr. John Tombes, and there he took his degrees in arts. He afterwards entered into orders, and was first chaplain to William

425907

Lord Say, and then to Charles Count Palatine of the Rhine, and Prince Elector of the Empire, with whom he continued for some time.

Upon the breaking out of the civil war, he joined with the parliament, and took the solemn league and covenant. He was afterwards made warden of Wadham College by the committee of parliament appointed for reforming the university; and being created bachelor of divinity, April 12, 1648, was the day following put in possession of his wardenship. Next year he was created doctor of divinity, and about that time took the engagement then enjoined by the powers in being.

In 1656, he married Robina, the widow of Peter French, formerly canon of Christ-Church, sister to Oliver, then Lord Protector. In 1659, he was by Richard the Protector made head of Trinity College in Cambridge, the best preferment in that university.

After king Charles the IId's restoration, he was ejected from thence, and became preacher to the honourable society of Gray's-Inn, and minister of St. Lawrence Jury, London, in the room of Dr. Ward. About this time he became a member of the royal society, was chosen one of their council, and proved one of their most eminent members, and chief benefactors. Soon after this he was

made dean of Rippon, and by the interest of the late duke of Buckingham, he was created bishop of Chester, and consecrated in the chapel of Ely-house in Holborn, the 15th of November, 1668, by Dr. Cosin, bishop of Durham; Dr. Laney, bishop of Ely; and Dr. Ward, bishop of Salisbury; on which occasion Dr. Tillotson, afterwards archbishop of Canterbury, preached an excellent sermon.

He was a person of great natural endowments, and by his indefatigable study attained to an universal insight into all, or at least most parts of useful learning. He was a great mathematician, and very much advanced the study of astronomy, both while he was warden of Wadham College in Oxford, and at London, when he was a member of the royal society. He was as well seen in mechanics and experimental philosophy as any man in his time, and was a great promoter of them. In divinity, which was his main business, he excelled, and was a very able critic; his talent of preaching was admirable, and more suited to profit than to please his hearers; he affected an apt and plain way of speech, and expressed his conceptions in a natural style. In his writings he was judicious and plain, and valued not circumstances so much as the substance. This appeared evident in whatever subject he undertook, which he always made easier for those that came after him.

He treated sometimes on matters that did not properly belong to his profession; but always with a design to make men wiser and better; which was his chief end in promoting universal knowledge, and one of the main reasons for his entering into the royal society. His virtues and graces were very uncommon; at least as to that degree of them to which he attained: his prudence was very remarkable, and seldom failed him; but he was so openhearted and sincere himself, that he was ready (except he knew some cause to the contrary) to think other men to be so too; by which he was sometimes imposed on.

His greatness of mind was evident to all that knew any thing of him, nor was the depth of his judgment less discernible. He never was eager in pursuit of dignities; but was advanced to them by his merit. He contemned riches as much as others admired them; and spent his ecclesiastical revenues in the service of the church from which he received them; and being secured against want, he would often say, that he would be no richer: and his conduct made it evident that he was as good as his word.

He was a stranger to revenge, and yet not insensible of personal injuries, especially such as reflected on his good name, if they proceeded from such as had a good reputation of their own. The

reproaches of others he despised; but frequently wished he had been better understood by the former: he bore it, however, patiently, as his misfortune; never requited them with the like measure; but always mentioned them with respect, and laid hold on all opportunities to oblige and do them good.

His conversation was profitable and pleasant; and his discourse was commonly of useful things; without occasioning trouble or weariness in those that conversed with him. He cultivated that most necessary (but too much neglected) part of friendship, to give seasonable reproof, and wholesome advice, upon occasion. This he did with a great deal of freedom; but with so much calmness and prudence, that it seldom gave offence.

He was particularly careful of the reputation of his friends; and would suffer no blot to lie upon the good name or memory of any of them, if he could help it.

His enemies, who were strangers to moderation themselves, made that virtue in which he excelled, the chief subject of their reproaches, as if he had been a person of unsteady principles, and not fixed in matters of religion; this drew severe censures upon him from archbishop Sheldon, bishop Fell, and archbishop Dolben, &c. without considering

that he could not but have a great deal of charity for dissenters, by reason of his education under Mr. John Dod his grandfather, a truly pious and learned man; who dissented in many things from the church of England long before the separation which afterwards followed upon archbishop Laud's severities and new impositions.

And as his said grandfather never approved of the extremities on the other side, but continued loyal to the last, and advised others to continue in their allegiance; in like manner Doctor Wilkins, (though he had clearness when the government was dissolved, to submit to the powers then in being, by which he procured an interest and a share in the government of both universities;) was always a friend to those who were loyal, and continued well affected to the church of England, and protected several of them by the interest he had in the then government.

After the restoration he conformed himself to the church of England, and stood up for her government and liturgy; but disliked vehemence in little and unnecessary things, and freely censured it as fanatacism on both sides.

Having thus conformed to the church himself, he was very willing to bring over others: in which he was not without success, especially in his own

diocese; where the extremes on both sides were as remarkable, as in most parts of the nation. Being a person of extensive charity himself, he was for an indulgence and a comprehension, in order to have brought our divisions in matters of religion to a conclusion; which drew upon him the hatred and obloquy of those who were for contrary measures.

His indefatigable pains in study brought the stone upon him; which proved incurable. He had for many days a prospect of death; which he viewed in its approaches, and gradual advances upon him: and a few days before his dissolution, he frequently said, that he found a sentence of death within himself. But in the height of his pain and apprehensions of death, he shewed no dismay or surprise, nor was ever heard to utter a word unbecoming a wise man, or a true christian. And thus he concluded his days with constancy of mind, contempt of the world, and cheerful hopes of a blessed eternity, through faith in our Lord Jesus Christ. He died in the house of his friend Dr. Tillotson, in Chancery-lane in London, on the 19th of November, 1672; and was buried on the 12th of December following, under the north wall of the chancel of the church of St. Lawrence Jewry, where he had formerly been minister. His funeral sermon was preached by Dr. William Lloyd, then dean of Bangor, (afterward Lord Bishop of Worcester) at the Guildhall chapel in London; by which,

those who are curious may be satisfied, that every part of the character here given him, may be justified to advantage.

As a further proof of it, and particularly of his unwearied endeavours to promote universal knowledge, it is proper to subjoin a catalogue of his works.

The first was entitled,

1. The Discovery of a New World; or, a Discourse tending to prove, that it is probable there may be another habitable World in the Moon. Printed at London, in quarto, 1638, and had four editions, the last in 1684.

2. Discourse concerning the Possibility of a Passage to the World in the Moon. Printed with the Discovery.

3. Discourse concerning a New Planet; tending to prove, that it is probable our Earth is one of the Planets. London, 1640, in octavo.

The author's name is put to none of the three; but they were so well known to be his, that Langrenus, in his map of the moon, (dedicated to the king of Spain) calls one of the spots of his selenographic map after his name.

4. Mercury; or, the Secret Messenger: shewing how a Man may with Privacy and Speed com-

municate his Thoughts to his Friend at any Distance. London, 1641. The publication of this was occasioned by the writing of a little thing, called Nuncius Inanimatus, by Francis Goodwin.

5. Mathematical Magic; or, the Wonders that may be performed by Mechanical Geometry. In two books. Printed at London in 1648, and 1680, in octavo.

6. Ecclesiastes; or, A Discourse of the Gift of Preaching, as it falls under the Rules of Art. London, 1646, 1647, 1651, 1653, and 1675, octavo.

7. Discourse concerning the Beauty of Providence, in all the rugged Passages of it. London, 1649, in twelves; and in 1677, the fifth edition, in octavo.

8. Discourse concerning the Gift of Prayer; shewing what it is; wherein it consists; and how far it is attainable by Industry, &c. London, 1653, and 1674, octavo.

9. Of the Principles and Duties of Natural Religion. Two books. London, 1675, octavo. Published by John Tillotson, D. D.

10. Sermons preached upon several Occasions. London, 1682, octavo. They are in number fifteen, published by Dr. Tillotson.

11. Essay towards a Real Character, and a Philosophical Language. London, 1668, folio.

12. An Alphabetical Dictionary: wherein all English Words, according to their various Significations, are either referred to their Places in the Philosophical Tables, or explained by such Words as are in those Tables. This is printed with the Essay.

CONTENTS.

VOL. I.

BOOK I.

THAT THE MOON MAY BE A WORLD.

PROPOSITION I.

Page

THAT the strangeness of this opinion is no sufficient reason why it should be rejected; because other certain truths have been formerly esteemed ridiculous, and great absurdities entertained by common consent. By way of Preface 3

II. That a plurality of worlds does not contradict any principle of reason or faith 13

III. That the heavens do not consist of any such pure matter which can privilege them from the like change and corruption, as these inferior bodies are liable unto 23

IV. That the moon is a solid, compacted, opaceous body 32

V. That the moon hath not any light of her own 36

VI. That there is a world in the moon, hath been the direct opinion of many ancient, with some modern mathematicians; and may probably be deduced from the tenets of others 43

VII. That those spots and brighter parts, which by our sight may be distinguished in the moon, do shew the difference betwixt the sea and land in that other world ... 51

Page

VIII. That the spots represent the sea, and the brighter parts the land 56

IX. That there are high mountains, deep vallies, and spacious plains in the body of the moon 63

X. That there is an atmosphæra, or an orb of gross vaporous air, immediately compassing the body of the moon 75

XI. That as their world is our moon, so our world is their moon 79

XII. That it is probable there may be such meteors belonging to that world in the moon, as there are with us ... 90

XIII. That it is probable there may be inhabitants in this other world; but of what kind they are is uncertain .. 100

XIV. That it is possible for some of our posterity to find out a conveyance to this other world; and, if there be inhabitants there, to have commerce with them 109

BOOK II.

THAT THE EARTH MAY BE A PLANET.

PROPOSITION I.

Page

That the seeming novelty and singularity of this opinion can be no sufficient reason to prove it erroneous 135

II. That the places of scripture which seem to intimate the diurnal motion of the sun or heavens, are fairly capable of another interpretation 149

III. That the holy ghost in many places of scripture does plainly conform his expressions to the error of our conceits, and does not speak of sundry things as they are in themselves, but as they appear unto us 159

IV. That divers learned men have fallen into great absurdities, whilst they have looked for the grounds of philosophy from the words of scripture 174

V. That the words of scripture, in their proper and strict construction, do not anywhere affirm the immobility of the earth 181

VI. That there is not any argument from the words of scripture, principles of nature, or observations in astronomy, which can sufficiently evidence the earth to be in the centre of the universe 189

VII. It is probable that the sun is in the centre of the world 203

VIII. That there is not any sufficient reason to prove the earth incapable of those motions which Copernicus ascribes unto it 208

IX. That it is more probable the earth does move than the heavens 231

X. That this hypothesis is exactly agreeable to common appearances 243

TO

THE READER.

IF amongst thy leisure hours, thou canst spare any for the perusal of this Discourse, and dost look to find somewhat in it which may serve for thy information and benefit; let me then advise thee to come unto it with an equal mind, not swayed by prejudice, but indifferently resolved to assent unto that truth which upon deliberation shall seem most probable unto thy reason; and then I doubt not, but either thou wilt agree with me in this assertion, or at least not think it to be as far from truth, as it is from common opinion.

Two cautions there are, which I would willingly admonish thee of in the beginning:

1. *That thou shouldst not here look to find an exact accurate treatise; since this discourse was but the fruit of some lighter studies, and those too huddled up in a short time; being first thought of and finished in the space of some few weeks; and therefore you cannot in reason expect that it should be so polished, as perhaps the subject would require, or the leisure of the author might have done it.*

2. *To remember that I promise only probable arguments for the proof of this opinion; and therefore you must not look that every consequence should be of an undeniable dependance; or that the truth of each argument should be measured by its necessity. I grant, that some astronomical appearances may possibly be solved otherwise than here they are: but the thing I aim at is this: that probably they may so be solved, as I have here set them down. Which, if it be granted (as I think it must) then I doubt not, but the indifferent reader will find some satisfaction in the main thing that is to be proved.*

TO THE READER.

Many ancient philosophers of the better note have formerly defended this assertion which I have here laid down; and it were to be wished, that some of us would more apply our endeavours unto the examination of these old opinions; which, though they have for a long time lain neglected by others, yet in them you may find many truths well worthy your pains and observation. It is a false conceit, for us to think that amongst the ancient variety and search of opinions, the best hath still prevailed. Time (saith the learned Verulam) seems to be of the nature of a river or stream; which carrieth down to us that which is light, or blown up, but sinketh that which is weighty and solid.

It is my desire, that by the occasion of this discourse, I may raise up some more active spirit to a search after other hidden and unknown truths: since it must needs be a great impediment unto the growth of sciences, for men still to plod on upon beaten principles, as to be afraid of entertaining any thing that may seem to contradict them. An unwillingness to take such things into examination is one of those errors of learning, in these times observed by the judicious Verulam. Questionless there are many secret truths which the ancients have passed over, that are yet left to make some of our age famous for their discovery.

If by this occasion I may provoke any reader to an attempt of this nature, I shall think myself happy, and this Work successful.

Farewell.

BOOK I.

THE

DISCOVERY OF A NEW WORLD;

OR,

A DISCOURSE

TENDING TO PROVE, THAT (IT IS PROBABLE) THERE MAY BE ANOTHER

HABITABLE WORLD IN THE MOON.

WITH

A DISCOURSE CONCERNING THE POSSIBILITY OF A PASSAGE THITHER.

BOOK I.

THAT THE MOON MAY BE A WORLD.

PROP. I.

BY WAY OF PREFACE.

That the strangeness of this opinion is no sufficient reason why it should be rejected; because other certain truths have been formerly esteemed ridiculous, and great absurdities entertained by common consent.

THERE is an earnestness and hungering after novelty, which doth still adhere unto all our natures; and it is part of that primitive image, that wide extent and infinite capacity at first created in the heart of man. For this, since its depravation in Adam, perceiving itself altogether emptied of any good, doth now catch after every new thing, conceiving that possibly it may find satisfaction among some of its fellow creatures. But our enemy the devil (who strives still to pervert our gifts, and beat us with our own weapons) hath so contrived it, that any truth doth now seem distasteful for that very reason, for which error is entertained; novelty. For let but some upstart heresy be set abroach, and presently there are some out of a curious humour; others, as if they watched an occasion of singularity, will take it up for canonical, and make it part of their creed and profession; whereas solitary truth cannot anywhere find so ready entertainment; but the same novelty which is esteemed the commendation of error, and makes that acceptable, is counted the fault of truth, and causes that to be rejected.

How did the incredulous world gaze at Columbus, when he promised to discover another part of the earth? And he could not for a long time, by his confidence or arguments, induce any of the christian princes, either to assent unto his opinion, or go to the charges of an experiment. Now if he, who had such good grounds for his assertion, could find no better entertainment among the wiser sort, and upper end of the world; it is not likely then that this opinion which I now deliver, shall receive any thing from the men of these days; especially our vulgar wits, but misbelief or derision.

It hath always been the unhappiness of new truths in philosophy, to be derided by those that are ignorant of the causes of things; and rejected by others, whose perverseness ties them to the contrary opinion; men whose envious pride will not allow any new thing for truth, which they themselves were not the first inventors of. So that I may justly expect to be accused of a pragmatical ignorance, and bold ostentation; especially, since for this opinion Xenophanes, a man whose authority was able to add some credit to his assertion, could not escape the like censure from others. For Natales Comes*, speaking of that philosopher, and this his opinion, saith thus: *Nonnulli ne nihil scisse videantur, aliqua nova monstra in philosophiam introducunt, ut alicujus rei inventores fuisse appareant.* "Some there "are who lest they might seem to know nothing, will "bring up monstrous absurdities in philosophy, that so "afterward they may be famed for the invention of some-"what." The same author doth also in another place† accuse Anaxagoras of folly for the same opinion. *Est enim non ignobilis gradus stultitiæ, vel si nescias quid dicas, tamen velle de rebus propositis hanc vel illam partem stabilire.* "'Tis none of the worst kinds of folly, boldly "to affirm one side or other, when a man knows not what "to say."

If these men were thus censured, I may justly then expect

* Mythol. lib. 3. c. 17. † Lib. 7. c. 1.

to be derided by most, and to be believed by few or none; especially since this opinion seems to carry in it so much strangeness, and contradiction to the general consent of others. But however, I am resolved that this shall not be any discouragement, since I know that it is not common opinion that can either add or detract from the truth. For,

1. Other truths have been formerly esteemed altogether as ridiculous as this can be.

2. Gross absurdities have been entertained by general opinion.

I shall give an instance of each, that so I may the better prepare the reader to consider things without a prejudice; when he shall see that the common opposition against this which I affirm, cannot anyway derogate from its truth.

1. Other truths have been formerly accounted as ridiculous as this. I shall specify that of the Antipodes, which have been denied, and laughed at by many wise men and great scholars; such as were Herodotus, Chrysostom, Austin, Lactantius, the venerable Bede, Lucretius the poet, Procopius, and the voluminous Abulensis, together with all those fathers or other authors who denied the roundness of the heavens*. Herodotus counted it so horrible an absurdity, that he could not forbear laughing to think of it. *Γελω δε ορων γης περιοδες γραφοντας, πολλης ηδη και ουδενα νόον εχοντας εξηγησαμενον οι Ωκεανοντε ρεόντα γραφουσι, περιξ την τε γην εοῦσαν κυκλο τερεα ως απο τορνε.* "I cannot chuse but "laugh, (saith he) to see so many men venture to describe "the earth's compass, relating those things that are without "all sense: as that the sea flows about the world, and that "the earth itself is round as an orb." But this great ignorance is not so much to be admired in him, as in those learned men of later times, when all sciences began to flourish in the world. Such were St. Chrysostom, who in his 14th homily upon the Epistle to the Hebrews, does make a challenge to any man that shall dare to defend that the heavens are round, and not rather as a tent. Thus

* Vid. Josep. Acosta, de nat. novi orbis, l. 1. cap. 1.

likewise St. Austin*, who censures that relation of the Antipodes to be an incredible fable; and with him agrees the eloquent Lactantius†. *Quid illi qui esse contrarios vestigiis nostris Antipodes putant? num aliquid loquuntur? aut est quispiam tam ineptus, qui credat esse homines, quorum vestigia sunt superiora quam capita? aut ibi quæ apud nos jacent inversa pendere? fruges & arbores deorsum versus crescere, pluvias & nives, & grandinem sursum versus cadere in terram? & miratur aliquis hortos pensiles inter septem mira narrari, quum philosophi, & agros, & maria, & urbes, & montes pensiles faciunt, &c.* "What (saith he) are they "that think there are Antipodes, such as walk with their "feet against ours? do they speak any likelihood; or is "there any one so foolish as to believe that there are men "whose heels are higher than their heads? that things "which with us do lie on the ground, do hang there? "that the plants and trees grow downwards, that the hail, "and rain, and snow fall upwards to the earth? and do we "admire the hanging orchards amongst the seven wonders, "whereas here the philosophers have made the fields and "seas, the cities and mountains hanging?" What shall we think (saith he in Plut.) that men do cling to that place like worms, or hang by their claws as cats? or if we suppose a man a little beyond the centre, to be digging with a spade, is it likely (as it must be according to this opinion) that the earth which he loosened, should of itself ascend upwards? Or else suppose two men with their middles about the centre, the feet of the one being placed where the head of the other is, and so two other men cross them; yet all these men thus situated, according to this opinion should stand upright; and many other such gross consequences would follow (saith he) which a false imagination is not able to fancy as possible. Upon which considerations, *Bede* also denies the being of any Antipodes, *Neque enim Antipodarum ullatenus est fabulis accommodandus*

* De civit. Dei, l. 16. cap. 9. † Institut. l. 3. cap. 24.

*assensus**. "Nor should we any longer assent to the fable "of Antipodes." So also Lucretius the poet speaking of the same subject, says,

Sed vanus stolidis hæc omnia finxerit error†.

That some idle fancy feigned these for fools to believe. Of this opinion was Procopius Gazæus‡; but he was persuaded to it by another kind of reason; for he thought that all the earth under us was sunk in the water, according to the saying of the Psalmist, *He hath founded the earth upon the seas*§; and therefore he accounted it not inhabited by any. Nay, Tostatus, a man of later years and general learning, doth also confidently deny that there are any such Antipodes, though the reason which he urges for it be not so absurd as the former; for the apostles, saith he, travelled through the whole habitable world, but they never passed the equinoctial‖: and if you answer, that they are said to go through all the earth, because they went through all the known world; he replies, That this is not sufficient, since Christ would have all men to be saved, and come to the knowledge of his truth¶, and therefore it is requisite that they should have travelled thither also, if there had been any inhabitants; especially since he did expressly command them to go and teach all nations, and preach the gospel through the whole world**: and therefore he thinks, that as there are no men, so neither are there seas, or rivers, or any other conveniency for habitation††. It is commonly related of one Virgilius, that he was excommunicated and condemned for a heretic by Zachary bishop of Rome, because he was not of the same opinion. But Baronius says‡‡, it was because he thought there was another habitable world within ours. However, you may well enough discern in these examples, how confident many of these great scholars were in so gross an error; how un-

* De ratione temporum, cap. 32. † De nat. rerum, lib. 1.
‡ Comment. in 1 cap. Gen. § Psalm xxiv. 2.
‖ Comment. in 1 Gen. ¶ 1 Tim. ii. 4. ** Matt. xxviii. 19.
†† Aventinus Annal. Boiorum, lib. 3. ‡‡ Annal. Eccles. A. D. 748.

likely, what an incredible thing it seemed to them, that there should be any Antipodes; and yet now this truth is as certain and plain, as sense or demonstration can make it. This then which I now deliver, is not to be rejected, though it may seem to contradict the common opinion.

2. Gross absurdities have been entertained by general consent. I might instance in many remarkable examples, but I will only speak of the supposed labour of the moon in her eclipses, because this is nearest to the chief matter in hand, and was received as a common opinion amongst many of the ancients; insomuch, that from hence they stiled eclipses by the name of παθη, passions, or in the phrase of the poets,

Solis lunæque labores.

And therefore Plutarch speaking of a lunary eclipse, relates, that at such times it was a custom amongst the Romans, (the most civil and learned people in the world) to sound brass instruments, and hold great torches toward the heaven*. Των δε Ρωμαιων (ωσπερ εςιν ενομισμενον) χαλκα τε παταγοις ανακαλεμενων το φως αυτης και πυρα πολλα δαλοις και δασσιν ανεχοντων προς τον ερανον. For by this means they supposed the moon was much eased in her labours; and therefore Ovid calls such loud instruments, the auxiliaries or helps of the moon,

Cum frustra resonant æra auxiliaria lunæ †.

And therefore the satyrist too, describing a loud scold, says, She was able to make noise enough to deliver the labouring moon.

Una laboranti poterit succurrere lunæ ‡.

Now the reason of all this their ceremony, was, because they feared the world would fall asleep, when one of its eyes began to wink, and therefore they would do what they could by loud sounds to rouse it from its drowsiness, and keep it awake; by bright torches, to bestow that light upon it which it began to lose.

* In vita Paul Æmil. † Metam. lib. 4. ‡ Juven. Sat. 6.

Some of them thought hereby to keep the moon in her orb, whereas otherwise she would have fallen down upon the earth, and the world would have lost one of its lights; for the credulous people believed that inchanters and witches could bring the moon down; which made Virgil say,

Cantus & è cælo possunt deducere lunam.

And those wizards knowing the times of her eclipses, would then threaten to shew their skill, by pulling her out of her orb. So that when the silly multitude saw that she began to look red, they presently feared they should lose the benefit of her light, and therefore made a great noise that she might not hear the sound of those charms, which would otherwise bring her down; and this is rendered for a reason of this custom by Pliny and Propertius *:

Cantus & è curru lunam deducere tentant,
Et facerent, si non æra repulsa sonent.

Plutarch gives another reason of it; and he says, it is because they would hasten the moon out of the dark shade wherein she was involved, that so she might bring away the souls of those saints that inhabit within her, which cry out by reason they are then deprived of their wonted happiness, and cannot hear the music of the spheres; but are forced to behold the torments and wailings of those damned souls which are represented to them as they are tortured in the region of the air. But whether this, or whatever else was the meaning of this superstition, yet certainly it was a very ridiculous custom, and bewrayed a great ignorance of those ancient times; especially since it was not only received by the vulgar, such as were men of less note and learning, but believed also by the more famous and wiser sort; such as were those great poets, Stesichorus and Pindar: and not only amongst the more sottish heathens, who might account that planet to be one of their gods, but the primitive christians also were in this kind guilty; which made St. Ambrose so tartly to rebuke those of his

* Nat. Hist. lib. 2. cap. 12.

time, when he said, *Tum turbatur carminibus globus lunæ, quando calicibus turbantur & oculi.* "When your heads "are troubled with cups, then you think the moon to be "troubled with charms."

And for this reason also did Maximus *, a bishop, write a homily against it, wherein he shewed the absurdity of that foolish superstition. I remember that Ludovicus Vives relates a more ridiculous story of a people that imprisoned an ass for drinking up the moon, whose image appearing in the water, was covered with a cloud as the ass was drinking; for which the poor beast was afterward brought to the bar, to receive a sentence according to his deserts; where the grave senate being set to examine the matter, one of the counsel (perhaps wiser than the rest) rises up, and out of his deep judgment, thinks it not fit that their town should lose its moon, but that rather the ass should be cut up, and that taken out of him; which sentence being approved by the rest of those politicians, as the subtilest way for the conclusion of the matter, was accordingly performed. But whether this tale were true or no, I will not question; however, there is absurdity enough in that former custom of the ancients, that may confirm the truth to be proved, and plainly declare the insufficiency of common opinion to add true worth or estimation unto any thing. So that from that which I have said, may be gathered thus much.

1. That a new truth may seem absurd and impossible, not only to the vulgar, but to those also who are otherwise wise men and excellent scholars: and hence it will follow, that every new thing which seems to oppose common principles, is not presently to be rejected, but rather to be pryed into with a diligent enquiry, since there are many things which are yet hid from us, and reserved for future discovery.

2. That it is not the commonness of an opinion that can privilege it for a truth; the wrong way is sometimes a well beaten path, whereas the right way (especially to hidden truths) may be less trodden and more obscure.

* Turinens. Episc.

True indeed, the strangeness of this opinion will detract much from its credit; but yet we should know that nothing is in itself strange, since every natural effect has an equal dependance upon its cause, and with the like necessity doth follow from it; so that it is our ignorance which makes things appear so: and hence it comes to pass, that many more evident truths seem incredible, to such who know not the causes of things. You may as soon persuade some country peasants that the moon is made of green cheese, (as we say) as that it is bigger than his cart-wheel, since both seem equally to contradict his sight, and he has not reason enough to lead him farther than his senses. Nay, suppose (saith Plutarch) a philosopher should be educated in such a secret place, where he might not see either sea or river, and afterwards should be brought out where one might shew him the great ocean, telling him the quality of that water, that it is brackish, salt, and not portable, and yet there were many vast creatures of all forms living in it, which make use of the water as we do of the air; questionless he would laugh at all this, as being monstrous lies and fables, without any colour of truth. Just so will this truth which I now deliver appear unto others, because we never dreamt of any such matter as a world in the moon; because the state of that place hath as yet been veiled from our knowledge, therefore we can scarcely assent to any such matter. Things are very hardly received, which are altogether strange to our thoughts and our senses. The soul may with less difficulty be brought to believe any absurdity, when as it has formerly been acquainted with some colours and probabilities for it; but when a new, and an unheard of truth shall come before it, though it have good grounds and reasons, yet the understanding is afraid of it as a stranger, and dares not admit it into his belief, without a great deal of reluctancy and trial. And besides, things that are not manifested to the senses, are not assented unto without some labour of mind, some travel and discourse of the understanding; and many lazy souls had rather quietly repose themselves in an easy error, than take pains to

search out the truth. The strangeness then of this opinion which I now deliver, will be a great hindrance to its belief; but this is not to be respected, by reason it cannot be helped. I have stood the longer in the Preface, because that prejudice which the mere title of the book may beget, cannot easily be removed without a great deal of preparation: and I could not tell otherwise how to rectify the thoughts of the reader, for an impartial survey of the following discourse.

I must needs confess, though I had often thought with myself that it was possible there might be a world in the moon, yet it seemed such an uncouth opinion, that I never durst discover it, for fear of being counted singular and ridiculous; but afterward, having read Plutarch, Galileus, Keplar, with some others, and finding many of mine own thoughts confirmed by such strong authority, I then concluded that it was not only possible there might be, but probable that there was another habitable world in that planet. In the prosecuting of this assertion, I shall first endeavour to clear the way from such doubts as may hinder the speed or ease of farther progress. And because the suppositions implied in this opinion, may seem to contradict the principles of reason or faith, it will be requisite that I first remove this scruple, shewing the conformity of them to both these, and proving those truths that may make way for the rest; which I shall labour to perform in the second, third, fourth, and fifth chapters, and then proceed to confirm such propositions which do more directly belong to the main point in hand.

PROP. II.

That a plurality of worlds doth not contradict any principle of reason or faith.

IT is reported of Aristotle, that when he saw the books of Moses, he commended them for such a majestic stile as might become a god; but withal, he censured that manner of writing to be very unfitting for a philosopher; because there was nothing proved in them, but matters were delivered as if they would rather command than persuade belief. And it is observed, that he sets down nothing himself, but he confirms it by the strongest reasons that may be found, there being scarce an argument of force for any subject in philosophy, which may not be picked out of his writings; and therefore it is likely if there were in reason a necessity of one only world, that he would have found out some such necessary proof as might confirm it; especially since he labours for it so much in two whole chapters. But now all the arguments which he himself urges in this subject, are very weak, and far enough from having in them any convincing power*. Therefore it is likely that a plurality of worlds doth not contradict any principle of reason. However, I will set down the two chief of his arguments from his own works, and from them you may guess the force of the other.

The first is this †: Since every heavy body doth naturally tend downwards, and every light body upwards, what a huddling and confusion must there be, if there were two places for gravity, and two places for lightness? For it is probable that the earth of that other world would fall down to this centre, and so mutually the air and fire here ascend to those regions in the other; which must needs much derogate from the providence of nature, and cause a great disorder in his works. But *ratio hæc est minimè firma,*

* De Cælo, l. 1. cap. 8, 9. † Ibid.

(saith Zanchy*.) And if you well consider the nature of gravity, you will plainly see there is no ground to fear any such confusion; for heaviness is nothing else but such a quality as causes a propension in its subject to tend downwards towards its own centre: so that for some of that earth to come hither, would not be said a fall, but an ascension, since it is moved from its own place; and this would be impossible (saith Ruvio †) because against nature, and therefore no more to be feared than the falling of the heavens.

If you reply, that then according to this, there must be more centres of gravity than one; I answer, it is very probable there are; nor can we well conceive what any piece of the moon would do, being severed from the rest in the free and open air, but only return unto it again.

Another argument he had from his master Plato ‡, That there is but one world, because there is but one first mover, God.

Infirma etiam est hæc ratio (saith Zanchy); and we may justly deny the consequence, since a plurality of worlds doth not take away the unity of the first Mover, *Ut enim forma substantialis, sic primum efficiens apparentem solummodo multiplicitatem induit per signatam materiam* (saith a countryman of ours §.) As the substantial form, so the efficient cause hath only an appearing multiplicity from its particular matter. You may see this point more largely handled, and these arguments more fully answered by Plutarch in his book, "Why Oracles are silent," and Jacob Carpentarius in his comment on Alcinous.

But our opposites, the interpreters themselves, (who too often do *jurare in verba magistri*) will grant that there is not any strength in these consequences; and certainly then such weak arguments could not convince that wise philosopher, who in his other opinions was wont to be swayed by the strength and power of reason; wherefore I should rather think that he had some by-respect, which made him

* De operibus Dei, par. 2. lib. 2. cap. 2. † De Cælo, l. 1. c. 9. q. 1.
‡ Metaphys. l. 12. c. 8. Diog. Laert. lib. 3.
§ Nic. Hill. de Philosoph. Epic. partic. 379.

first assent to this opinion, and afterwards strive to prove it. Perhaps it was because he feared to displease his scholar Alexander*; of whom it is related, that he wept to hear a disputation of another world, since he had not then attained the monarchy of this; his restless wide heart would have esteemed this globe of earth not big enough for him, if there had been another; which made the satyrist say of him,

Æstuat infœlix angusto limite mundi†.

"That he did vex himself, and sweat in his desires, as "being penned up in a narrow room, when he was con-"fined but to one world." Before, he thought to seat himself next the gods, but now, when he had done his best, he must be content with some equal, or perhaps superior kings.

It may be, that Aristotle was moved to this opinion, that he might thereby take from Alexander the occasion of this fear and discontent; or else, perhaps, Aristotle himself was as loth to hold the possibility of a world which he could not discover, as Alexander was to hear of one which he could not conquer. It is likely that some such by-respect moved him to this opinion, since the arguments he urges for it are confessed by his zealous followers and commentators, to be very slight and frivolous; and they themselves grant, what I am now to prove, that there is not any evidence in the light of natural reason, which can sufficiently manifest that there is but one world.

But however some may object, would it not be inconvenient and dangerous to admit of such opinions that do destroy those principles of Aristotle which all the world hath so long followed?

This question is much controverted by some of the Romish divines‡: Campanella hath writ a treatise in defence of it, in whom you may see many things worth the reading and notice.

To it I answer, That this position in philosophy doth

* Plutarch. de tranq. anim. † Juvenal. ‡ Apologia pro Galileo.

not bring any inconveniency to the rest, since it is not Aristotle, but truth, that should be the rule of our opinions; and if they be not both found together, we may say to him, as he said to his master Plato *,

" Though Plato were his friend, yet he would rather " adhere to truth than him."

I must needs grant, that we are all much beholden to the industry of the ancient philosophers, and more especially to Aristotle, for the greater part of our learning; but yet it is not ingratitude to speak against him, when he opposeth truth; for then many of the fathers would be very guilty, especially Justin, who hath writ a treatise purposely against him. But suppose this opinion were false, yet it is not against the faith, and so it may serve for the better confirmation of that which is true; the sparks of error being forced out by opposition, as the sparks of fire by the striking of the flint and steel. But suppose too that it were heretical, and against the faith, yet may it be admitted with the same privilege as Aristotle, from whom many more dangerous opinions have proceeded: as that the world is eternal; that God cannot have while to look after these inferior things; that after death there is no reward or punishment, and such like blasphemies; which strike directly at the fundamentals of our religion.

So that it is justly to be wondered, why some should be so superstitious in these days, as to stick closer unto him, than unto scripture, as if his philosophy were the only foundation of all divine truths.

Upon these grounds, both St. Vincentius and Serafinus de Firmo (as I have seen them quoted) think that Aristotle was the viol of God's wrath, which was poured out upon the waters of wisdom by the third angel †: but for my part, I think the world is much beholden to him for all his sciences. But yet it were a shame for these later ages, to rest ourselves merely upon the labours of our forefathers, as if they had informed us of all things to be known; and

* Ethic. l. 1. c. 6. † Rev. xvi. 4.

when we are set upon their shoulders, not to see further than they themselves did. It were a superstitious, a lazy opinion, to think Aristotle's works the bounds and limits of all human invention, beyond which there could be no possibility of reaching. Certainly there are yet many things left to discovery, and it cannot be any inconveniency for us to maintain a new truth, or rectify an ancient error.

But the position (say some) is directly against scripture; for,

1. Moses tells us but of one world, and his history of the creation had been very imperfect, if God had made another.

2. St. John, speaking of God's works, says, he made the world, in the singular number, and therefore there is but one. It is the argument of Aquinas*, and he thinks that none will oppose it, but such who with Democritus esteem some blind chance, and not any wise Providence, to be the framer of all things.

3. The opinion of more worlds has in ancient times been accounted a heresy; and Baronius affirms that for this very reason Virgilius was cast out of his bishoprick †, and excommunicated from the church.

4. A fourth argument there is urged by Aquinas: if there be more worlds than one, then they must either be of the same, or of a diverse nature; but they are not of the same kind; for this were needless, and would argue an improvidence, since one would have no more perfection than the other ‡: not of divers kinds; for then one of them could not be called the world or universe, since it did not contain universal perfection. I have cited this argument, because it is so much stood upon by Julius Cæsar la Galla §, one that has purposely writ a treatise against this opinion which I now deliver; but the dilemma is so blunt, that it cannot cut on either side, and the consequences so weak, that I dare trust them without an answer: and (by the way) you

* Part 1. Q. 47. Art. 3. † Annal. Eccl. A. D. 748. ‡ Ibid.
§ De Phenom. in Orbe Lunæ.

may see this later author in that place, where he endeavours to prove a necessity of one world, doth leave the chief matter in hand, and take much needless pains to dispute against Democritus, who thought that the world was made by the casual concourse of atoms in a great vacuum. It should seem that either his cause or his skill was weak, or else he would have ventured upon a stronger adversary. These arguments which I have set down are the chiefest which I have met with against this subject; and yet the best of these hath not force enough to endanger the truth that I have delivered.

Unto the two first it may be answered, that the negative authority of scripture is not prevalent in those things which are not the fundamentals of religion.

But you will reply, though it do not necessarily conclude, yet it is probable if there had been another world, we should have had some notice of it in scripture.

I answer, it is as probable that the scripture should have informed us of the planets, they being very remarkable parts of the creation; and yet neither Moses, nor Job, nor the Psalms (the places most frequent in astronomical observations) nor any other scripture mention any of them but the sun and moon. Because the difference betwixt them and the other stars, was known only to those who were learned men, and had skill in astronomy. As for that expression in Job *, כוכבי בקר, the stars of the morning, it is in the plural number, and therefore cannot properly be applied to Venus. And for that in Isaiah, הילל, it is confessed to be a word of obscure interpretation, and therefore is but by guess translated in that sense. It being a true and common rule, that *Hebræi rei sideralis minime curiosi cœlestium nominum penuriâ laborant.* The Jews being but little skilled in astronomy, their language does want proper expressions for the heavenly bodies; and therefore they are fain

* Job xxxviii. 7. Isa. xiv. 12. Fromond. Vesta, t. 3. cap. 2. So 2 Reg. xxiii. 5. מזלות, which is interpreted both for the planets and for the twelve signs.

sometimes to attribute the same name unto divers constellations.

Now if the Holy Ghost had intended to reveal unto us any natural secrets, certainly he would never have omitted the mention of the planets, *Quorum motu nihil est quod de conditoris sapientiâ testatur evidentius apud eos qui capiunt**. Which do so evidently set forth the wisdom of the Creator. And therefore you must know that it is besides the scope of the Old Testament or the New, to discover anything unto us concerning the secrets of philosophy. It is not his intent in the New Testament, since we cannot conceive how it might anyway belong either to the historical, exegetical, or prophetical parts of it: nor is it his intent in the Old Testament, as is well observed by our countryman Master Wright †. *Non Mosis aut prophetarum institutum fuisse videtur mathematicas aliquas aut phisicas subtiltates promulgare, sed ad vulgi captum & loquendi morem, quemadmodum nutrices infantulis solent, sese accommodare.* "It is not the endeavour of Moses or the "prophets to discover any mathematical or philosophical "subtilties; but rather to accommodate themselves to "vulgar capacities, and ordinary speech, as nurses are wont "to use their infants." True indeed, Moses is there to handle the history of the creation. But it is certain (saith Calvin ‡) that his purpose is to treat only of the visible form of the world, and those parts of it which might be most easily understood by the ignorant and ruder sort of people, and therefore we are not thence to expect the discovery of any natural secret. *Artes reconditas aliunde discat qui volet; hic spiritus dei omnes simul sine exceptione docere voluit.* As for more hidden arts, they must be looked for elsewhere; the Holy Ghost did here intend to instruct all without exception. And therefore it is observed, that Moses does not anywhere meddle with such matters as were very hard to be conceived; for being to inform the

* Keplar. introduct. in Mart. † In Epist. ad Gilbert.
‡ Calvin in 1 Gen.

common people as well as others, he does it after a vulgar way, as it is commonly noted, declaring the original chiefly of those things which are obvious to the sense; and being silent of other things which then could not well be apprehended. And therefore Pererius * proposing the question, why the creation of plants and herbs is mentioned, but not of metals and minerals?

Answers: *Quia istarum rerum generatio est vulgo occulta & ignota:* Because these things are not so commonly known as the other; and he adds, *Moses non omnia, sed manifesta omnibus enarranda suscepit.* Moses did not intend to relate unto us the beginnings of all things, but those only which were most evident unto all men. And therefore too, Aquinas observes †, that he writes nothing of the air; because that being invisible, the people knew not whether there were any such body or no. And for this very reason St. Jerom ‡ also thinks that there is nothing exprest concerning the creation of angels; because the rude and ignorant vulgar were not so capable of apprehending their natures. And yet notwithstanding, these are as remarkable parts of the creation, and as fit to be known as another world. And therefore the Holy Ghost too, uses such vulgar expressions, which set things forth rather as they appear than as they are, as when he calls the moon one of the greater lights §, whereas it is the least that we can see in the whole heavens. So afterwards speaking of the great rain which drowned the world, he says, the windows of heaven were opened ‖, because it seemed to come with that violence, as if it were poured out from windows in the firmament ¶.

And in reference to this, a drowth is described in sundry other places ** by the heavens being shut up. So that the phrases which the Holy Ghost uses concerning these things, are not to be understood in a literal sense; but rather as

* Com. in 1 Gen. 11. † Part 1. Q. 68. Art. 3.
‡ Epist. 139. ad Cypri. So Pererius in 2 Gen. § Gen. i. 16.
‖ Gen. xi. Mal. iii. 10. ¶ Sir Walter Rawl. cap. 7. sect. 6.
** Deut. xi. 17. 1 Reg. iii. 55. Luke iv. 25.

vulgar expressions; and this rule is set down by St. Austin*, where speaking concerning that in the psalm, who stretched the earth upon the waters, he notes, that when the words of scripture shall seem to contradict common sense or experience, there are they to be understood in a qualified sense, and not according to the letter. And it is observed, that for want of this rule †, some of the ancients have fastened strange absurdities upon the words of the scripture. So St. Ambrose esteemed it a heresy to think that the sun and stars were not very hot, as being against the words of scripture, Psalm xix. 6. where the Psalmist says, that there is nothing that is hid from the heat of the sun. So others there are that would prove the heavens not to be round, out of that place, Psalm civ. 2. *He stretched out the heavens like a curtain.* So Procopius also was of opinion, that the earth was founded upon the waters; nay, he made it part of his faith, proving it out of Psalm xxiv. 2. *He hath founded the earth upon the seas, and established it upon the floods.* These and such like absurdities have followed, when men look for the grounds of philosophy in the words of scripture. So that, from what hath been said, I may conclude that the silence of scripture concerning any other world, is not sufficient argument to prove that there is none. Thus for the two first arguments.

Unto the third, I may answer, that this very example is quoted by others, to shew the ignorance of those primitive times, who did sometimes condemn what they did not understand; and have often censured the lawful and undoubted parts of mathematics for heretical, because they themselves could not perceive a reason of it. And therefore their practice in this particular is no sufficient testimony against us.

But lastly, I answer to all the above-named objections, that the term (world) may be taken in a double sense, more generally for the whole universe, as it implies in it

* L. 2. in Gen. Ps. cxxxvi. 6.

† Hexamer lib. 2. Item Basil. Hom. 3. in Gen. Wisd. ii. 4. xvii. 5. Ecclus. xliii. 3, 4. Com. in c. 1 Gen.

the elementary and æthereal bodies, the stars and the earth. Secondly, more particularly for an inferior world, consisting of elements.

Now the main drift of all these arguments, is to confute a plurality of worlds in the first sense; and if there were any such, it might (perhaps) seem strange, that Moses or St. John should either not know, or not mention its creation. And Virgilius was condemned for this opinion, because he held *quod sit alius mundus sub terra, aliusque sol & luna*, (as Baronius) that within our globe of earth, there was another world, another sun and moon, and so he might seem to exclude this from the number of the other creatures.

But now there is no such danger in this opinion, which is here delivered; since this world is said to be in the moon, whose creation is particularly expressed.

So that in the first sense, I yield that there is but one world, which is all that the arguments do prove; but understand it in the second sense, and so I affirm there may be more, nor do any of the above-named objections prove the contrary.

Neither can this opinion derogate from the divine wisdom (as Aquinas thinks) but rather advance it, shewing a compendium of Providence, that could make the same body a world, and a moon; a world for habitation, and a moon for the use of others, and the ornament of the whole frame of nature. For as the members of the body serve not only for the preservation of themselves, but for the use and conveniency of the whole, as the hand protects the head as well as saves itself*; so is it in the parts of the universe, where each one may serve as well for the conservation of that which is within it, as the help of others without it.

Mersennus a late jesuit †, proposing the question whether or no the opinion of more worlds than one, be heretical and

* Cusanus de Doct. Ignor. l. 2. c. 12.

† Comment. in Gen. Qu. 19. Art. 2.

against the faith? He answers it negatively; because it does not contradict any express place of scripture, or determination of the church. And though (saith he) it seems to be a rash opinion, as being against the consent of the fathers; yet if this controversy be chiefly philosophical, then their authorities are not of such weight. Unto this it may be added, that the consent of the fathers is prevalent only in such points as were first controverted amongst them, and then generally decided one way, and not in such other particulars as never fell under their examination and dispute.

I have now in some measure shewed that a plurality of worlds does not contradict any principle of reason or place of scripture; and so cleared the first part of that supposition which is implied in the opinion.

It may next be enquired, whether it is possible there may be a globe of elements in that which we call the æthereal parts of the universe; for if this (as it is according to the common opinion) be privileged from any change or corruption, it will be in vain then to imagine any element there; and if we will have another world, we must then seek out some other place for its situation. The third proposition therefore shall be this.

PROP. III.

That the heavens do not consist of any such pure matter, which can privilege them from the like change and corruption as these inferior bodies are liable unto.

IT hath been often questioned amongst the ancient fathers and philosophers, what kind of matter that should be of which the heavens are framed. Some think that they consist of a fifth substance distinct from the four elements, as Aristotle holds*, and with him

* De Cælo, lib. 1. cap. 2.

some of the late schoolmen; whose subtil brains could not be content to attribute to those vast glorious bodies, but common materials, and therefore they themselves had rather take pains to prefer them to some extraordinary nature; whereas notwithstanding, all the arguments they could invent, were not able to convince a necessity of any such matter, as is confessed by their own side*. It were much to be desired, that these men had not in other cases, as well as this, multiplied things without necessity; and, as if there had not been enough to be known in the secrets of nature, have spun out new subjects from their own brains, to find more work for future ages. I shall not mention their arguments, since it is already confessed, that they are none of them of any necessary consequence; and besides, you may see them set down in any of the books *de Cælo*.

But it is the general consent of the fathers, and the opinion of Lombard, that the heavens consist of the same matter with these sublunary bodies. St. Ambrose is so confident of it, that he esteems the contrary a heresy †. True indeed, they differ much among themselves, some thinking them to be made of fire, others of water, and others of both: but herein they generally agree, that they are all framed of some element or other; which Dionysius Carthusianus ‡ collects from that place in Genesis, where the heavens are mentioned in their creation, as divided only in distance from the elementary bodies, and not as being made of any new matter. To this purpose others cite the derivation of the Hebrew word שמים, *quasi* שם *ibi* & מים *aquæ* or *quasi* אש *ignis* & מים *aquæ*, because they are framed out of these elements. But concerning this, you may see sundry discourses more at large in Ludovicus Molina, Eusebius Nirembergius, with divers others. The venerable Bede thought the planets to consist of all the four elements §; and it is likely that the

* Colleg. Connimb. de cælo. l. 1. c. 2. q. 6. art. 3. † In Hexam. lib. 4.
‡ Enarrat. in Genes. art. 10. § In operc. 6 dierum disput. 5.

other parts of it are of an aereous substance, as will be shewed afterwards*: however, I cannot now stand to recite the arguments for either; I have only urged these authorities to countervail Aristotle and the schoolmen, and the better to make way for a proof of their corruptibility.

The next thing then to be enquired after, is, Whether they be of a corruptible nature†; not whether they can be destroyed by God; for this scripture puts out of doubt.

Nor whether or no in a long time they would wear away and grow worse, for from any such fear they have been lately privileged‡. But whether they are capable of such changes and vicissitudes, as this inferior world is liable unto.

The two chief opinions concerning this, have both erred in some extremity, the one side going so far from the other, that they have both gone beyond the right; whilst Aristotle hath opposed the truth as well as the Stoics.

Some of the ancients have thought, that the heavenly bodies have stood in need of nourishment from the elements, by which they were continually fed, and so had divers alterations by reason of their food. This is fathered on Heraclitus, followed by that great naturalist Pliny, and in general attributed to all the Stoicks§. You may see Seneca expressly to this purpose in these words. *Ex illa alimenta omnibus animalibus, omnibus satis, omnibus stellis dividuntur; hinc profertur quo sustineantur tot sidera tam exercitata, tam avida, per diem, noctemque, ut in opera, ita in pastu.* Speaking of the earth, he says, from thence it is that nourishment is divided to all the living creatures, the planets and the stars; hence were sustained so many constellations, so laborious, so greedy,

* In lib. de Mundi constit. † 2 Pet. iii. 12.

‡ By Doctor Hakewill. Apol. lib. 2. § Plutarch de plac. Philos. l. 2. c. 17. Nat. Hist. l. 2. c. 9. Nat. quest. lib. 2. cap. 5.

both day and night, as well in their feeding as working. Thus also Lucan sings,

Necnon oceano pasci Phœbumque polumque credimus.

Unto these, Ptolomy also*, that learned Egyptian, seemed to agree, when he affirms that the body of the moon is moister and cooler than any of the other planets, by reason of the earthly vapours that are exhaled unto it. You see these ancients thought the heavens to be so far from this imagined incorruptibility, that rather like the weakest bodies they stood in need of some continual nourishment, without which they could not subsist.

But Aristotle and his followers were so far from this†, that they thought those glorious bodies could not contain in them any such principles as might make them liable to the least change or corruption; and their chief reason was, because we could not in so long a space discern any alteration amongst them. But unto this I answer:

1. Supposing we could not, yet would it not hence follow that there were none, as he himself in effect doth confess in another place; for speaking concerning our knowledge of the heavens, he says‡, it is very imperfect and difficult, by reason of the vast distance of those bodies from us, and because the changes which may happen unto them, are not either big enough, or frequent enough to fall within the apprehension and observation of our senses; no wonder then, if he himself be deceived in his assertions concerning these particulars. But yet, in this he implies, that if a man were nearer to these heavenly bodies, he would be a fitter judge to decide this controversy than himself. Now it is our advantage, that by the help of Galileus's glass, we are advanced nearer unto them, and the heavens are made more present to us than they were before. However, as it is with us, where there be many vicissitudes and successions of things, though the earth abideth for

* 1 Apostol. † De Cælo, l. 1. c. 3.
‡ De cælo, l. 2. cap. 5.

ever; so likewise may it be amongst the planets; in which, though there should be divers alterations, yet they themselves may still continue of the same quantity and light.

2. Though we could not by our senses see such alterations, yet our reason might perhaps sufficiently convince us of them. Nor can we well conceive how the sun should reflect against the moon, and yet not produce some alteration of heat. Diogenes the philosopher was hence persuaded, that those scorching heats had burnt the moon into the form of a pumice-stone.

3. I answer, That there have been some alterations observed there; witness those comets which have been seen above the moon; as also those spots or clouds that encompass the body of the sun; amongst which, there is a frequent succession by a corruption of the old, and a generation of new. So that though Aristotle's consequence were sufficient, when he proved that the heavens were not corruptible, because there have not any changes been discovered in it; yet this by the same reason must be as prevalent, that the heavens are corruptible, because there have been so many alterations observed there. But of these, together with a farther confirmation of this proposition, I shall have occasion to speak afterwards: in the mean space, I will refer the reader to that work of Scheinen, a late jesuit, which he titles his *Rosa Ursina**, where he may see this point concerning the corruptibility of the heavens largely handled, and sufficiently confirmed.

There are some other things, on which I might here take an occasion to enlarge myself; but because they are directly handled by many others, and do not immediately belong to the chief matter in hand, I shall therefore refer the reader to their authors, and omit any large proof of them myself, as desiring all possible brevity.

1. The first is this: That there are no solid orbs. If there be a habitable world in the moon, (which I now af-

* Lib. 4. par. 2. cap. 24. 35.

firm) it must follow, that her orb is not solid, as Aristotle supposed; and if not hers, why any of the other? I rather think that they are all of a fluid (perhaps aereous) substance. St. Ambrose and St. Basil did endeavour to prove this out of that place in Isaiah*, where they are compared to smoke, as they are both quoted by Rhodiginus. Eusebius Nierembergus doth likewise from that place†, confute the solidity and incorruptibility of the heavens, and cites for the same interpretation the authority of Eustachius, of Antioch; and St. Austin‡, I am sure, in one place seems to assent unto this opinion, though he does often in his other works contradict it.

If you esteem the testimony of the ancient fathers, to be of any great force or consequence in a philosophical dispute, you may see them to this purpose in Sixtus Senensis, lib. 5. Biblioth. annot. 14. The chief reasons that are commonly urged for the confirmation of it, are briefly these three.

1. From the altitude of divers comets, which have been observed to be above the planets; through whose orbs (if they had been solid) there would not have been any passage. To these may be added those lesser planets lately discovered about Jupiter and Saturn, for which astronomers had not yet framed any orbs.

2. From that uncertainty of all astronomical observations, which will follow upon the supposition of such solid spheres. For then we should never discern any star, but by a multitude of refractions, and so consequently we could not possibly find their true situations, either in respect of us, or in regard of one another: since whatever the eye discerns by a refracted beam, it apprehends to be in some other place than wherein it is. But now this would be such an inconvenience, as would quite subvert the grounds and whole art of astronomy, and therefore is by no means to be admitted.

* Isa. li. l. 6. Ant. lect. l. 1. c. 4.

† Hist. nat. l. 2. c. 11. 13.

‡ In lib. sup. Gen. ad. lit.

Unto this it is commonly answered, That all those orbs are equally diaphanous, though not of a continued quantity. We reply, That supposing they were, yet this cannot hinder them from being the causes of refraction, which is produced as well by the diversity of superficies, as the different perspicuity of bodies. Two glasses put together, will cause a diverse refraction from another single one, that is but of equal thickness and perspicuity.

3. From the different height of the same planet at several times. For, if according to the usual hypothesis, there should be such distinct, solid orbs, then it would be impossible that the planets should intrench upon one another's orbs, or that two of them at several times should be above one another, which notwithstanding hath been proved to be so by later experience. Tycho hath observed, that Venus is sometimes nearer to us than the Sun or Mercury, and sometimes farther off than both: which appearances Regiomontanus himself does acknowledge, and withal, does confess that they cannot be reconciled to the common hypothesis.

But for your better satisfaction herein, I shall refer you to the above-named Scheiner, in his *Rosa Ursina**, in whom you may see both authorities and reason very largely and distinctly set down for this opinion. For the better confirmation of which, he adjoins also some authentical epistles of Fredericus Cæsius Lynceus, a noble prince, written to Bellarmine, containing divers reasons to the same purpose. You may also see the same truth set down by Johannes Pena, in his preface to Euclid's Opticks, and Christoph. Rothmannus, both who thought the firmament to be only air; and though the noble Tycho do dispute against them †, yet he himself holds, *Quod propius ad veritatis penetralia accedit hæc opinio, quam Aristotelica vulgariter approbata, quæ cælum pluribus realibus atque imperviis orbibus citra rem replevit.* "That this opinion "comes nearer to the truth, than that common one of

* Lib. 4. p. 11. 2. c. 7. 26. 30. † De stell. l. 15, 72. l. 1. c. 9.

" Aristotle, which hath to no purpose filled the heavens " with such real and impervious orbs.

2. There is no element of fire, which must be held with this opinion here delivered; for if we suppose a world in the moon, then it will follow, that the sphere of fire either is not there, where it is usually placed in the concavity of his orb, or else that there is no such thing at all; which is most probable, since there are not any such solid orbs, that by their swift motion might heat and enkindle the adjoining air, which is imagined to be the reason of that element. The arguments that are commonly urged to this purpose, are these.

1. That which was before alleged concerning the refractions which will be caused by a different medium. For if the matter of the heavens be of one thickness, and the element of fire another, and the upper region of air distinct from both these, and the lower region several from all the rest; there will then be such a multiplicity of refractions, as must necessarily destroy the certainty of all astronomical observations. All which inconveniences might be avoided, by supposing (as we do) that there is only one orb of vaporous air which encompasses our earth; all the rest being æthereal, and of the same perspicuity.

2. The situation of this element does no way agree with Aristotle's own principles; or that common Providence of nature, which we may discern in ordinary matters. For if the heavens be without all elementary qualities, as is usually supposed, then it would be a very incongruous thing for the element of fire to be placed immediately next unto it; since the heat of this is the most powerful and vigorous quality that is among all the rest: and nature in her works, does not join extremes, but by something of a middle disposition. So in the very frame of our bodies, the bones which are of a hard substance, and the flesh of a soft, are not joined together but by the intercession of membranes and gristles, such as being of a middle nature may fitly come betwixt.

3. It is not conceiveable for what use or benefit there should be any such element in that place; and certain it is, that nature does not do any thing in vain.

4. Betwixt two extremes there can be but one medium; and therefore between those two opposite elements of earth and water, it may seem more convenient to place only the air, which shall partake of middle qualities different from both.

5. Fire does not seem so properly and directly to be opposed to any thing as ice; and if the one be not an element, why should the other?

If you object, that the fire which we commonly use does always tend upwards; I answer, This cannot prove that there is a natural place for such an element, since our adversaries themselves do grant, that culinary and elementary fire are of different kinds. The one does burn, shine, and corrupt its subject; the other disagrees from it in all these respects. And therefore from the ascent of the one, we cannot properly infer the being or the situation of the other.

But for your farther satisfaction herein, you may peruse Cardan, Johannes Pena, that learned Frenchman the noble Tycho, with divers others who have purposely handled this proposition.

3. I might add a third, viz. That there is no music of the spheres; for if they be not solid, how can their motion cause any such sound as is conceived? I do the rather meddle with this, because Plutarch speaks as if a man might very conveniently hear that harmony, if he were an inhabitant in the moon. But I guess that he said this out of incogitancy, and did not well consider those necessary consequences which depend upon his opinion. However, the world would have no great loss in being deprived of this music, unless at some times we had the privilege to hear it*: then indeed Philo the Jew thinks it would save us the charges of diet, and we might live at

* De somniis.

an easy rate by feeding at the ear only, and receiving no other nourishment; and for this very reason, says he, was Moses enabled to tarry forty days and forty nights in the mount without eating any thing, because he there heard the melody of the heavens.—*Risum teneatis.* I know this music hath had great patrons, both sacred and profane authors, such as Ambrose, Bede, Boetius, Anselm, Plato, Cicero, and others; but because it is not now, I think, affirmed by any, I shall not therefore bestow either pains or time in arguing against it.

It may suffice that I have only named these three last, and for the two more necessary, have referred the reader to others for satisfaction. I shall in the next place proceed to the nature of the moon's body, to know whether that be capable of any such conditions, as may make it possible to be inhabited, and what those qualities are wherein it more nearly agrees with our earth.

PROP. IV.

That the Moon is a solid, compacted, opacous body.

I Shall not need to stand long in the proof of this proposition, since it is a truth already agreed on by the general consent of the most and the best philosophers.

It is solid, in opposition to fluid, as is the air; for how otherwise could it beat back the light which it receives from the sun?

But here it may be questioned, whether or no the moon bestow her light upon us by the reflection of the sun-beams from the superficies of her body, or else by her own illumination? Some there are who affirm this latter part. So Averroes*, Cælius Rhodiginus†, Julius Cæsar‡, &c. And their reason is, because this light is discerned in many

* De cœlo l. 2. com. 49.
† Ant. lection. l. 20. c. 4.
‡ De phænom. lunæ. c. 11.

places, whereas those bodies which give light by reflexion, can there only be perceived where the angle of reflexion is equal to the angle of incidence, and this is only in one place; as in a looking-glass, those beams which are reflected from it, cannot be perceived in every place where you may see the glass, but only there where your eye is placed on the same line whereon the beams are reflected.

But to this I answer, That the argument will not hold of such bodies whose superficies is full of unequal parts and gibbosities, as the moon is. Wherefore it is as well the more probable as the more common opinion, that her light proceeds from both these causes, from reflexion and illumination; nor doth it herein differ from our earth, since that also hath some light by illumination: For how otherwise would the parts about us in a sun-shine day appear so bright, when as the rays of reflexion cannot enter into our eye?

For the better illustration of this, we may consider the several ways whereby divers bodies are enlightened. Either as water by admitting the beams into its substance; or as air and thin clouds, by transmitting the rays quite through their bodies; or as those things that are of an opacous nature, and smooth superficies, which reflect the light only in one place; or else as those things which are of an opacous nature, and rugged superficies, which by a kind of circumfluous reflexion, are at the same time discernible in many places, as our earth and the moon.

2. It is compact, and not a spungy and porous substance. But this is denied by Diogenes*, Vitellio†, and Reinoldus‡, and some others, who held the moon to be of the same kind of nature as a pumice-stone; and this, say they, is the reason why in the sun's eclipses, there appears within her a duskish ruddy colour, because the sun-beams being refracted in passing through the pores of her body, must necessarily be represented under such a colour.

* Plut. de pla. Phil. l. 2. c. 13. † Opt. l. 4.

‡ Com. Purbac. Theo. p. 164.

But I reply, if this be the cause of her redness, then why doth she not appear under the same form when she is about a sextile aspect, and the darkened part of her body is discernible? for then also do the same rays pass through her, and therefore in all likelihood should produce the same effect; and notwithstanding those beams are then diverted from us, that they cannot enter into our eyes by a straight line, yet must the colour still remain visible in her body. And besides, according to this opinion, the spots would not always be the same, but diverse as the various distance of the sun requires. Again, if the sun-beams did pass through her, why then hath she not a tail (saith Scaliger*) as the comets? Why doth she appear in such an exact round? and not rather attended with a long flame, since it is merely this penetration of the sun-beams that is usually attributed to be the cause of beards in blazing stars.

3. It is opacous, not transparent or diaphanous like crystal or glass, as Empedocles thought†, who held the moon to be a globe of pure congealed air, like hail inclosed in a sphere of fire; for then,

1. Why does she not always appear in the full? since the light is dispersed through all her body?

2. How can the interposition of her body so darken the sun‡, or cause such great eclipses as have turned day into night; that have discovered the stars, and frightened the birds with such a sudden darkness, that they fell down upon the earth? as it is related in divers histories. And therefore Herodotus telling of an eclipse which fell in Xerxes's time, describes it thus: ὁ ἡλιος ἐκλιπὴν τὴν ἐκ τοῦ οὐρανοῦ ἕδρην ἀφανὴς ἦν§. The sun leaving his wonted seat in the heavens, vanished away: all which argues such a great darkness as could not have been, if her body had been perspicuous. Yet some there are who interpret all these relations to be hyperbolical expressions; and the noble Tycho thinks it naturally impossible that any eclipse should

* Scaliger Exercit. 80. sect. 13.
† Plut. de facie lunæ.
‡ Thucid. Livii. Plut. de facie lunæ.
§ Herodot. l. 7. c. 37.

cause such darkness, because the body of the moon can never totally cover the sun. However, in this he is singular, all other astronomers (if I may believe Keplar) being on the contrary opinion, by reason the diameter of the moon does for the most part appear bigger to us than the diameter of the sun.

But here Julius Cæsar once more puts in to hinder our passage. The moon (saith he *) is not altogether opacous, because it is still of the same nature with the heavens, which are incapable of total opacity: and his reason is, because perspicuity is an inseparable accident of those purer bodies; and this he thinks must necessarily be granted; for he stops there, and proves no further; but to this I shall defer an answer till he hath made up his argument.

We may frequently see, that her body does so eclipse the sun, as our earth doth the moon. And besides, the mountains that are observed there, do cast a dark shadow behind them, as shall be shewed afterwards †. Since then the like interposition of them both, doth produce the like effect, they must necessarily be of the like natures, that is, alike opacous, which is the thing to be shewed; and this was the reason (as the interpreters guess) why Aristotle ‡ affirmed the moon to be of the earth's nature, because of their agreement in opacity; whereas all the other elements, save that, are in some measure perspicuous.

But the greatest difference which may seem to make our earth altogether unlike the moon, is, because the one is a bright body, and hath light of its own, and the other a gross dark body which cannot shine at all. It is requisite therefore that in the next place I clear this doubt, and shew that the moon hath no more light of her own than our earth.

* De phænom. lunæ, c. 11. † Prop. 9. ‡ In lib. de animalib.

PROP V.

That the Moon hath not any light of her own.

IT was the fancy of some of the Jews, and more especially of Rabbi Simeon*, that the moon was nothing else but a contracted sun; and that both those planets, at their first creation, were equal both in light and quantity. For, because God did then call them both great lights, therefore they inferred that they must be both equal in bigness. But a while after (as the tradition goes) the ambitious moon put up her complaint to God against the sun, shewing that it was not fit there should be two such great lights in the heavens; a monarchy would best become the place of order and harmony. Upon this, God commanded her to contract herself into a narrower compass; but she being much discontented hereat, replies, What! because I have spoken that which is reason and equity, must I therefore be diminished? This sentence could not chuse but much trouble her; and for this reason was she in great distress and grief for a long space; but that her sorrow might be some way pacified, God bid her be of good cheer, because her privileges and charter should be greater than the sun's; he should appear in the day time only, she both in the day and night; but her melancholy being not satisfied with this, she replied again, That that alas was no benefit; for in the day time she should be either not seen, or not noted. Wherefore, God to comfort her up, promised, that his people the Israelites should celebrate all their feasts and holidays by a computation of her months; but this being not able to content her, she has looked very melancholy ever since; however, she hath still reserved much light of her own.

Others there were, that did think the moon to be a round globe; the one half of whose body was of a bright substance, the other half being dark; and the divers con-

* Tostatus in 1 Gen. Hyeron. de sancta fide Hebræomast. l. 2. c. 4.

versions of those sides towards our eyes, caused the variety of her appearances. Of this opinion was Berosus, as he is cited by Vitruvius*; and St. Austin† thought it was probable enough. But this fancy is almost equally absurd with the former, and both of them sound rather like fables, than philosophical truths. You may commonly see how this latter does contradict frequent and easy experience; for it is observed, that that spot which is perceived about her middle when she is in the increase, may be discerned in the same place when she is in the full: whence it must follow, that the same part which was before darkened, is after enlightened, and that the one part is not always dark, and the other light of itself. But enough of this; I would be loth to make an enemy, that I may afterwards overcome him, or bestow time in proving that which is already granted; I suppose now, that neither of them hath any patrons, and therefore need no confutation.

It is agreed upon by all sides, that this planet receives most of her light from the sun; but the chief controversy is, whether or no she hath any of her own? The greater multitude affirm this. Cardan‡ amongst the rest, is very confident of it; and he thinks that if any of us were in the moon at the time of her greatest eclipse, *lunam aspiceremus non secus ac innumeris cereis splendidissimis accensis, atque in eas oculis defixis cæcutiremus*; "we should perceive so great a brightness of her own, that would blind "us with the mere sight, and when she is enlightened by "the sun, then no eagle's eye (if there were any there) is "able to look upon her." This Cardan says, and he doth but say it, without bringing any proof for its confirmation. However, I will set down the arguments that are usually urged for this opinion, and they are taken either from scripture or reason; from scripture is urged that place, 1 Cor. xv. where it is said, There is one glory of the sun, and another glory of the moon. Ulysses Albergettus urges

* Lib. 9. Architect. † Narrat. Psalm. item ep. 119.
‡ De subtil. l. 3.

that in Matth. xxiv. 29. ἡ σελήνην ϐ δώσει το φεγγος αυτης, the moon shall not give her light: therefore (says he) she hath some of her own.

But to these we may easily answer, that the glory and light there spoken of, may be said to be hers, though it be derived, as you may see in many other instances.

The arguments from reason are taken either,

1. From that light which is discerned in her, when there is a total eclipse of her own body, or of the sun.

2. From the light which is discerned in the darker part of her body, when she is but a little distant from the sun.

1. For when there are any total eclipses, there appears in her body a great redness, and many times light enough to cause a remarkable shade, as common experience doth sufficiently manifest: but this cannot come from the sun, since at such times either the earth or her own body shades her from the sun-beams; therefore it must proceed from her own light.

2. Two or three days after the new moon, we may perceive light in her whole body, whereas the rays of the sun reflect but upon a small part of that which is visible; therefore it is likely that there is some light of her own.

In answering to these objections, I shall first shew, that this light cannot be her own; and then declare that which is the true reason of it.

That it is not her own, appears,

1. Because then she would always retain it; but she has been sometimes altogether invisible, when as notwithstanding some of the fixed stars of the fourth or fifth magnitude might easily have been discerned close by her: as it was in the year 1620*.

2. This may appear likewise from the variety of it at divers times; for it is commonly observed that sometimes it is of a brighter, sometimes of a darker appearance; now redder, and at another time of a more duskish colour. The observation of this variety in divers eclipses, you may

* Keplar ep. Astron. cop. l. 6. p. 5. sect. 2.

see set down by Keplar and many others*. But now this could not be, if that light were her own, that being constantly the same, and without any reason of such an alteration: so that thus I may argue.

If there were any light proper to the moon, then would that planet appear brightest when she is eclipsed in her perige, being nearest to the earth; and so consequently more obscure and duskish when she is in her apoge or farthest from it; the reason is, because the nearer any enlightened body comes to the sight, by so much the more strong are the species, and the better perceived. This sequel is granted by some of our adversaries, and they are the very words of noble Tycho; *Si lũna genuino gauderet lumine, utique cum in umbra terræ esset, illud non amitteret, sed eo evidentius exerceret; omne enim lumen in tenebris, plus splendet cum alio majore fulgore non præpeditur* †. If the moon had any light of her own, then would she not lose it in the earth's shadow, but rather shine more clearly; since every light appears greater in the dark, when it is not hindered by a more conspicuous brightness.

But now the event falls out clean contrary, (as observation doth manifest, and our opposites themselves do grant) the moon appearing with a more reddish and clear light when she is eclipsed, being in her apoge or farthest distance, and a more blackish iron colour when she is in her perige or nearest to us, therefore she hath not any light of her own. Nor may we think that the earth's shadow can cloud the proper light of the moon from appearing, or take away any thing from her inherent brightness‡; for this were to think a shadow to be a body, an opinion altogether misbecoming a philosopher, as Tycho grants in the fore-cited place, *Nec umbra terræ corporeum quid est, aut densa aliqua substantia, ut lunæ lumen obtenebrare possit, atque id visui nostro præripere, sed est quædam privatio luminis solaris, ob interpositum opacum corpus terræ.*

* Opt. astron. c. 7. num. 3. † De nova stella. l. 1. c. 10.
‡ Reinold Comment. in Purb. Theor. p. 164.

Nor is the earth's shadow any corporeal thing, or thick substance, that it can cloud the moon's brightness, or take it away from our sight; but it is a mere privation of the sun's light by reason of the interposition of the earth's opacous body.

3. If she had any light of her own, then that would itself be either such a ruddy brightness as appears in the eclipses, or else such a leaden duskish light, as we see in the darker parts of her body, when she is a little past the conjunction. (That it must be one of these, may follow from the opposite arguments;) but it is neither of these, therefore she hath none of her own.

1. It is not such a ruddy light as appears in eclipses; for then why can we not see the like redness, when we may discern the obscurer parts of the moon?

You will say, perhaps, that then the nearness of that greater light takes away that appearance.

I reply, This cannot be. For then, why does Mars shine with his wonted redness, when he is near the moon? Or why cannot her greater brightness make him appear white, as the other planets? Nor can there be any reason given, why that greater light should represent her body under a false colour.

2. It is not such a duskish leaden light, as we see in the darker part of her body, when she is about a sextile aspect distant from the sun; for then, why does she appear red in the eclipses; since mere shade cannot cause such a variety? For it is the nature of darkness, by its opposition, rather to make things appear of a more white and clear brightness, than they are in themselves. Or, if it be the shade, yet those parts of the moon are then in the shade of her body, and therefore in reason should have the like redness. Since, then, neither of these lights are hers; it follows, that she hath none of her own. Nor is this a singular opinion, but it hath had many learned patrons: such was Macrobius*, who being for this quoted of Rho-

* Somn. Scip. l. 1. c. 20. Lect. antiq. l. 1. c. 15.

diginus, he calls him, *vir reconditissimæ scientiæ*, a man who knew more than ordinary philosophers; thus commending the opinion in the credit of the author. To him assents the venerable Bede *, upon whom the gloss hath this comparison: As the looking-glass represents not any image within itself, unless it receive some from without; so the moon hath not any light, but what is bestowed by the sun. To these agreed Albertus Magnus †, Scaliger ‡, Mæslin §, Keplar, and more especially Mulapertius ‖; whose words are more pat to the purpose than others, and therefore I shall set them down as you may find them in his preface to his treatise concerning the Austriaca Sydera: *Luna, Venus, et Mercurius, terrestris et humidæ sunt substantiæ; idcoque de suo non lucere, sicut nec terra.* The Moon, Venus, and Mercury (saith he), are of an earthly and moist substance; and therefore have no more light of their own, than the earth hath. Nay, some there are who think (though without ground), that all the other stars do receive that light whereby they appear visible to us, from the sun. So Ptolomy, Isidore Hispalensis ¶, Albertus Magnus **, and Bede ††: much more then, must the moon shine with a borrowed light.

But enough of this. I have now sufficiently shewed what at the first I promised; that this light is not proper to the moon. It remains in the next place, that I tell you the true reason of it. And here, I think it is probable, that the light which appears in the moon at the eclipses, is nothing else but the second species of the sun's rays, which pass through the shadow unto her body: and from a mixture of this second light with the shadow, arises that redness which at such times appears unto us. I may call it *lumen crepusculinum*, the Aurora of the moon, or such a kind of blushing light that the sun causes when he is near

* In lib. de nat. rer. † De 4 Coævis. Q. 4. Art. 21. ‡ Exercit. 62.
§ Epitom Astron. l. 4. p. 2. ‖ Epit. Astron. Cop. l. 6. part 2. sect. 2.
¶ Origin. l. 3. c. 60. ** De Cælo, l. 2.
†† De ratione temp. c. 4. Item Plin. l. 2. c. 6. Hugo de Sancto Victore. Annot in Gen. vi.

his rising, when he bestows some small light upon the thicker vapours. Thus we see commonly the sun being in the horizon, and the reflection growing weak, how his beams make the waters appear very red.

The Moabites, in Jehoram's time, when they rose early in the morning, and beheld the waters afar off, mistook them for blood*. *Et causa hujus est, quia radius solaris in aurora contrahit quondam rubedinem, propter vapores combustos manentes circa superficiem terræ, per quos radii transeunt; & ideo cum repercutiantur in aqua ad oculos nostros, trahunt secum eundem ruborem, & faciunt apparere locum aquarum, in quo est repercussio, esse rubrum*; saith Tostatus. The reason is, because of his rays; which being in the lower vapours, those do convey an imperfect mixed light upon the waters. Thus the moon being in the earth's shadow, and the sun-beams which are round about it not being able to come directly unto her body; yet some second rays there are, which passing through the shadow, make her appear in that ruddy colour: so that she must appear brightest, when she is eclipsed, being in her apoge or greatest distance from us; because then the cone of the earth's shadow is less, and the refraction is made through a narrower medium. So on the contrary, she must be represented under a more dark and obscure form when she is eclipsed, being in her perige, or nearest to the earth; because then she is involved in a greater shadow, or bigger part of the cone; and so the refraction passing through a greater medium, the light must needs be weaker which doth proceed from it. If you ask now, What the reason may be of that light which we discern in the darker part of the new moon? I answer; it is reflected from our earth; which returns as great a brightness to that planet, as it receives from it. This I shall have occasion to prove afterward.

I have now done with these propositions, which were set down to clear the passage, and confirm the suppositions

* 2 Kings iii. 22. 2 Quæst. in hoc cap.

implied in the opinion. I shall in the next place proceed to a more direct treating of the chief matter in hand.

PROP. VI.

That there is a world in the Moon, hath been the direct opinion of many ancient, with some modern mathematicians; and may probably be deduced from the tenets of others.

SINCE this opinion may be suspected of singularity, I shall therefore first confirm it by sufficient authority of divers authors, both ancient and modern; that so I may the better clear it from the prejudice either of an upstart fancy, or an obsolete error. This is by some attributed to Orpheus, one of the most ancient Greek poets*, who speaking of the moon, says thus; ἡ πολλ' ὄρεα ἐχει, πολλ' ἄστεα, πολλα μελαθρα, that it hath many mountains, and cities, and houses in it. To him assented Anaxagoras, Democritus, and Heraclides†; all who thought it to have firm solid ground, like to our earth; containing in it many large fields, champion grounds, and divers inhabitants.

Of this opinion likewise was Xenophanes‡, as he is cited for it by Lactantius§; though that father (perhaps) did mistake his meaning, whilst he relates it thus: *Dixit Xenophanes, intra concavum lunæ esse aliam terram, et ibi aliud genus hominum, simili modo vivere sicut nos in hac terra, &c.* As if he had conceived the moon to be a great hollow body, in the midst of whose concavity, there should be another globe of sea and land, inhabited by men, as our earth is; whereas, it seems to be more likely by the relation of others, that this philosopher's opinion is to be understood in the same sense as it is here to be proved. True indeed, the father condemns this assertion, as an equal

* Plut. de plac. phil. l. 2. c. 13.
† Ibid. c. 25.
‡ Diog. Laert. l. 2. & l. 9.
§ Div. Inst. l. 3. c. 13.

absurdity to that of Anaxagoras, who affirmed the snow to be black: but no wonder; for in the very next chapter it is, that he does so much deride the opinion of those who thought there were antipodes. So that his ignorance in that particular, may perhaps disable him from being a competent judge in any other the like point of philosophy. Unto these agreed Pythagoras, who thought that our earth was but one of the planets which moved round about the sun, (as Aristotle relates it of him *;) and the Pythagoreans in general did affirm that the moon also was terrestrial, and that she was inhabited as this lower world: that those living creatures and plants which are in her, exceed any of the like kind with us in the same proportion, as their days are longer than ours, viz. by fifteen times. This Pythagoras † was esteemed by all, of a most divine wit, as appears especially by his valuation amongst the Romans; who being commanded by the oracle to erect a statue to the wisest Grecian ‡, the senate determined Pythagoras to be meant; preferring him in their judgments before the divine Socrates, whom their gods pronounced the wisest. Some think him a Jew by birth; but most agree that he was much conversant amongst the learneder sort and priests of that nation, by whom he was informed of many secrets; and (perhaps) this opinion which he vented afterwards in Greece, where he was much opposed by Aristotle in some worded disputations, but never confuted by any solid reason.

To this opinion of Pythagoras did Plato also assent, when he considered that there was the like eclipse made by the earth; and this, that it had no light of its own, that it was so full of spots §. And therefore we may often read in him and his followers, of an *ætherea terra*, and *lunares populi*, an æthereal earth, and inhabiters in the moon; but afterwards this was mixed with many ridiculous fancies: for some of them considering the mysteries implied in the

* De Cœlo, l. 2. c. 13. † Plut. ibid. cap. 30.
‡ Plin. Nat. Hist. l. 34. cap. 6.
§ Plat de conviviis. Macrob. Somn. Scip. l. 1. c. 11.

number three, concluded that there must necessarily be a trinity of worlds, whereof the first is this of ours; the second in the moon, whose element of water is represented by the sphere of Mercury, the air by Venus, and the fire by the sun. And that the whole universe might the better end in earth as it began; they have contrived it, that Mars shall be a sphere of the fire, Jupiter of air, Saturn of water; and above all these, the Elysian fields, spacious and pleasant places appointed for the habitation of those unspotted souls, that either never were imprisoned in, or else now have freed themselves from any commerce with the body. Scaliger * speaking of this Platonic fancy, *quæ in tres trientes mundum quasi assem divisit*, thinks it is confutation enough to say, it is Plato's. However, for the first part of this assertion, it was assented unto by many others, and by reason of the grossness and inequality of this planet, it was frequently called *quasi terra cælestis* †, as being esteemed the sediment and more imperfect part of those purer bodies; you may see this proved by Plutarch, in that delightful work which he properly made for the confirmation of this particular. With him agreed Alcinous and Plotinus, later writers ‡.

Thus Lucian also in his discourse of a journey to the moon, where though he does speak many things out of mirth and in a jesting manner; yet in the beginning of it he does intimate that it did contain some serious truths concerning the real frame of the universe.

The cardinal Cusanus and Jornandus Brunus §, held a particular world in every star; and therefore one of them defining our earth, he says, it is *stella quædam nobilis, quæ lunam et calorem et influentiam habet aliam, et diversam ab omnibus aliis stellis*; "a noble star, having a distinct "light, heat, and influence from all the rest." Unto this "Nicholas Hill ||, a countryman of ours, was inclined,

* Exerc. 62. † De facie Lunæ.
‡ Instit. ad discip. plat. Cal. Rhodig. l. 1. c. 4.
§ Cusa de doct. ign. l. 2. cap. 12. || Philos. Epicur. par. 434.

when he said, *astrea terræ natura probabilis est:* "That "it is probable the earth hath a starry nature."

But the opinion which I have here delivered, was more directly proved by Mæslin*, Keplar†, and Galilæus‡; each of them late writers, and famous men for their singular skill in astronomy. Keplar calls this world by the name of Levania, from the Hebrew word לבנה which signifies the moon, and our earth by the name of *volva, a volvendo;* because it does by reason of its diurnal revolution appear unto them constantly to turn round; and therefore he stiles those who live in that hemisphere which is towards us, by the title of Subvolvani, because they enjoy the sight of this earth; and the others Privolvani, *quia sunt privati conspectu volvæ*, because they are deprived of this privilege. But Julius Cæsar, whom I have above quoted, speaking of their testimony whom I cite for this opinion, viz. Keplar and Galilæus§, affirms that to his knowledge they did but jest in those things which they write concerning this; and as for any such world, he assuredly knows they never so much as dreamt of it. But I had rather believe their own words, than his pretended knowledge.

It is true indeed, in some things they do but trifle, but for the main scope of those discourses, it is as manifest they seriously meant it, as any indifferent reader may easily discern: as for Galilæus, it is evident that he did set down his own judgment and opinion in these things; otherwise sure Campanella (a man as well acquainted with his opinion, and perhaps his person, as Cæsar was) would never have writ an apology for him. And besides, it is very likely if it had been but a jest, Galilæus would never have suffered so much for it, as report saith afterwards he did.

And as for Keplar, I will only refer the reader to his own words, as they are set down in the preface to the fourth book of his Epitom; where his purpose is to make

* In Thesibus.
† Dissertatio cum Nunc.
‡ Nuncius Sydereus. Somn. Astr.
§ De phænom. Lunæ, c. 4.

an apology for the strangeness of those truths that he was there to deliver, amongst which there are divers things to this purpose concerning the nature of the moon. He professes that he did not publish them either out of a humour of contradiction, or a desire of vain-glory, or in a jesting way to make himself or others merry, but after a considerate and solemn manner for the discovery of the truth.

Now as for the knowledge which Cæsar pretends to the contrary, you may guess what it was by his strange confidence in other assertions, and his boldness in them may well derogate from his credit in this. For speaking of Ptolemy's Hypothesis *, he pronounces this verdict, *Impossibile est excentricorum et epicyclorum positio, nec aliquis est ex mathematicis adeo stultus qui veram illam existimet.* "The position of excentrics and epicycles is altogether im- "possible, nor is there any mathematician such a fool as "to think it true." I should guess he could not have knowledge enough to maintain any other hypothesis, who was so ignorant in mathematics as to deny that any good author held this. For I would fain know whether there were never any that thought the heavens to be solid bodies, and that there were such kinds of motion as is by those feigned orbs supplied; if so, Cæsar la Galla was much mistaken. I think his assertions are equally true, that Galilæus and Keplar did not hold this; and that there were none which ever held that other. Thus much for the testimony of those who were directly of this opinion.

But, in my following discourse, I shall most insist on the observation of Galilæus, the inventor of that famous perspective, whereby we may discern the heavens hard by us; whereby those things which others have formerly guessed at, are manifested to the eye, and plainly discovered beyond exception or doubt; of which admirable invention, these latter ages of the world may justly boast, and for this expect to be celebrated by posterity. It is related of Eudoxus, that he wished himself burnt with Phaeton, so he

* Cap. 7.

might stand over the sun to contemplate its nature; had he lived in these days, he might have enjoyed his wish at an easier rate; and scaling the heavens by this glass, might plainly have discerned what he so much desired. Keplar considering those strange discoveries which this perspective had made, could not choose but cry out in a προσκυνησις and rapture of admiration, *O multiscium et quovis sceptro pretiosius perspicillum! an qui te dextrâ tenet, ille non dominus constituatur operum Dei?* And Johannes Fabricius*, an elegant writer, speaking of the same glass, and for this invention preferring our age before those former times of greater ignorance, says thus: *Adeo sumus superiores veteribus, ut quam illi carminis magici pronunciatu demissam representasse putantur, nos non tantum innocenter demittamus, sed etiam familiari quodam intuitu ejus quasi conditionem intueamur.* "So much are we above the ancients, that whereas they were fain by their magical "charms to represent the moon's approach, we cannot "only bring her lower with a greater innocence, but may "also with a more familiar view behold her condition." And because you shall have no occasion to question the truth of those experiments which I shall afterwards urge from it, I will therefore set down the testimony of an enemy; and such a witness hath always been accounted prevalent: you may see it in the above-named Cæsar la Galla†, whose words are these. *Mercurium caduceum gestantem, cælestia nunciare, et mortuorum animas ab inferis revocare sapiens finxit antiquitas. Galilæum vero novum Jovis interpretem telescopio caduceo instructum syderd aperire, et veterum philosophorum manes ad superos revocare solers nostra ætas videt et admiratur.* "Wise antiquity fabled Mercury carrying a rod in his hand to relate news from heaven, and call back the souls of the "dead; but it hath been the happiness of our industrious "age, to see and admire Galilæus (the new ambassador of "the gods), furnished with his perspective to unfold the

* De macula in sol. obser. † De phænom. cap. 1.

"nature of the stars, and awaken the ghosts of the ancient "philosophers." So worthily and highly did these men esteem of this excellent invention.

Now if you would know what might be done by this glass, in the sight of such things as were nearer at hand, the same author will tell you, when he says *, That by it those things which could scarce at all be discerned by the eye, at the distance of a mile and a half, might plainly and distinctly be perceived for sixteen Italian miles, and that as they were really in themselves, without any transposition or falsifying at all. So that what the ancient poets were fain to put in a fable, our more happy age hath found out in a truth; and we may discern as far with these eyes which Galilæus hath bestowed upon us, as Lynceus could with those which the poets attributed unto him. But if you yet doubt whether all these observations were true, the same author may confirm you, when he says they were shewed, *Non uni aut alteri, sed quamplurimis, neque gregariis hominibus, sed præcipuis atque disciplinis omnibus, necnon mathematicis et opticis præceptis optime instructis sedulâ ac diligenti inspectione* *. "Not to one or two, but "to very many, and those not ordinary men, but to those "who were well versed in mathematics and optics; and "that not with a mere glance, but with a sedulous and di- "ligent inspection." And lest any scruple might remain unanswered, or you might think the men who beheld al this, though they might be skilful, yet they came with credulous minds, and so were more easy to be deluded: He adds that it was shewed, *Viris qui ad experimenta hæc contradicendi animo accesserant* †. "To such as were "come with a great deal of prejudice, and an intent of "contradiction." Thus you may see the certainty of those experiments which were taken by this glass. I have spoken the more concerning it, because I shall borrow many things in my further discourse, from those discoveries which were made by it.

* De phænom. c. 6. † Cap. 1. ‡ Cap. 5.

I have now cited such authors, both ancient and modern, who have directly maintained the same opinion. I told you likewise in the proposition, that it might probably be deduced from the tenets of others*: such were Aristarchus, Philolaus, and Copernicus, with many other later writers, who assented to their hypothesis; so Joach. Rhelicus, David Origanus Lansbergius, Guil. Gilbert; and, (if I may believe Campanella) *innumeri alii Angli et Galli*†; very many others, both English and French, all who affirmed our earth to be one of the planets, and the sun to be the centre of all, about which the heavenly bodies did move. And how horrid soever this may seem at the first, yet it is likely enough to be true, nor is there any maxim or observation in optics (saith Pena) that can disprove it.

Now if our earth were one of the planets (as it is according to them) then why may not another of the planets be an earth?

Thus have I shewed you the truth of this proposition. Before I proceed farther, it is requisite that I inform the reader what method I shall follow in the proving of this assertion, That there is a world in the moon.

The order by which I shall be guided, will be that which Aristotle uses in his book *De Mundo* (if that book were his).

First, περι των εν αυτη, of those chief parts which are in it; not the elementary and ethereal (as he doth there), since this does not belong to the present question, but of the sea and land, &c. Secondly, περι αυτην παθων, of those things which are extrinsical to it, as the seasons, meteors, and inhabitants.

* See the second book, 1 prop. † Apologia pro Galilæo.

PROP. VII.

That those spots and brighter parts, which by our sight may be distinguished in the Moon, do shew the difference betwixt the sea and land in that other world.

FOR the clear proof of this proposition, I shall firs reckon up and refute the opinions of others concern ing the matter and form of those spots, and then shew the greater probability of this present assertion, and how agreeable it is to that truth which is most commonly received As for the opinions of others concerning these, they have been very many: I will only reckon up those which are common and remarkable.

Some there are that think those spots do not arise from any deformity of the parts, but a deceit of the eye, which cannot at such a distance discern an equal light in that planet: but these do but only say it, and shew not any reason for the proof of their opinion. Others think that there are some bodies betwixt the sun and moon, which keeping off the light in some parts, do by their shadow produce these spots which we there discern*.

Others would have them to be the figure of the seas or mountains here below, represented there as in a looking-glass. But none of those fancies can be true, because the spots are still the same, and not varied according to the difference of places; and besides, Cardan† thinks it is impossible that any image should be conveyed so far, as there to be represented unto us at such at a distance. But it is commonly related of Pythagoras, that he by writing wha he pleased in a glass, by the reflexion of the same species would make those letters to appear in the circle of the moon, where they should be legible by any other, who

* So Bede in l. de Mund. constit. † De subtil. lib. 3.

might at that time be some miles distant from him. Agrippa * affirms this to be possible, and the way of performing it not unknown to himself, with some others in his time. It may be, that bishop Godwin did by the like means perform those strange conclusions, which he professes in his Nuncius Inanimatus; where he pretends, that he can inform his friends of what he pleases, though they be an hundred miles distant, *forte etiam, vel milliare millesimum* (they are his own words), and perhaps a thousand; and all this in a little space, quicker than the sun can move.

Now, what conveyance there should be for so speedy a passage, I cannot conceive, unless it be carried with the light, than which we know not any thing quicker. But of this only by the way. However, whether those images can be represented so or not, yet certain it is, those spots are not such representations. Some think that when God had at first created too much earth to make a perfect globe, not knowing well where to bestow the rest, he placed it in the moon, which ever since hath so darkened it in some parts: but the impiety of this is sufficient confutation, since it so much detracts from the divine power and wisdom.

The stoics † held that planet to be mixed of fire and air; and in their opinion, the variety of its composition caused her spots: being not ashamed to stile the same body a goddess, calling it Diana, Minerva, &c. and yet affirm it to be an impure mixture of flame and smoke, and fuliginous air.—But this planet cannot consist of fire, saith Plutarch, because there is not any fuel to maintain it. And the poets have therefore feigned Vulcan to be lame, because he can no more subsist without wood or other fuel, than a lame man without a staff.

Anaxagoras thought all the stars to be of an earthly nature, mixed with some fire; and as for the sun, he affirmed it to be nothing else but a fiery stone: for which latter opi-

* Occulta Philos. l. 1. cap. 6. † Plut. de placit. phil. l. 2. c. 25.

nion, the Athenians sentenced him to death*; those zealous idolaters counting it a great blasphemy to make their god a stone; whereas notwithstanding, they were so senseless in their adoration of idols, as to make a stone their god. This Anaxagoras affirmed the moon to be more terrestrial than the other planets, but of a greater purity than any thing here below; and the spots he thought were nothing else but some cloudy parts intermingled with the light which belonged to that planet; but I have above destroyed the supposition on which this fancy is grounded. Pliny† thinks they arise from some drossy stuff, mixed with that moisture which the moon attracts unto herself; but he was of their opinion who thought the stars were nourished by some earthly vapours; which you may commonly see refuted in the Commentators on the books De Cœlo.

Vitellio and Reinoldus‡ affirm the spots to be the thicker parts of the moon, into which the sun cannot infuse much light; and this (say they) is the reason why in the sun's eclipses the spots and brighter parts are still in some measure distinguished, because the sun-beams are not able so well to penetrate through those thicker, as they may through the thinner parts of that planet. Of this opinion also was Cæsar la Galla, whose words are these§; "The "moon doth there appear clearest, where she is transpi- "cuous, not only through the superficies, but the substance "also; and there she seems spotted, where her body is "most opacous." The ground of this his assertion was, because he thought the moon did receive and bestow her light by illumination only, and not at all by reflection; but this, together with the supposed penetration of the sun-beams, and the perspicuity of the moon's body I have above answered and refuted.

* Josephus l. 2. con. App. August. de Civit. Dei, l. 18. c. 41.

† Nat. Hist. l. 2. c. 9. ‡ Opt. lib. 9. Comment. in Purb. p. 164.

§ Ex qua parte luna est transpicua non solum secundum superficiem, sed etiam secundum substantiam, eatenus clara, ex qua autem parte opaca est, eatenus obscura videtur. De Phænom. cap. 11.

The more common and general opinion is, that the spots are the thinner parts of the moon, which are less able to reflect the beams that they receive from the sun, and this is most agreeable to reason; for if the stars are therefore brightest, because they are thicker and more solid than their orbs, then it will follow, that those parts of the moon which have less light, have also less thickness *. It was the providence of nature (say some) that so contrived that planet to have these spots within it; for since that is nearest to those lower bodies which are so full of deformity, it is requisite that it should in some measure agree with them; and as in this inferior world, the higher bodies are the most complete, so also in the heavens, perfection is ascended unto by degrees, and the moon being the lowest, must be the least pure; and therefore Philo the Jew interpreting Jacob's dream concerning the ladder †, doth in an allegory shew how that in the fabric of the world, all things grow perfecter as they grow higher; and this is the reason (saith he) why the moon doth not consist of any pure simple matter, but is mixed with air, which shews so darkly within her body.

But this cannot be a sufficient reason; for though it were true that nature did frame every thing perfecter as it was higher, yet is it as true that nature frames every thing fully perfect for that office to which she intends it. Now had she intended the moon merely to reflect the sunbeams, and give light, the spots then had not so much argued her providence, as her unskilfulness and oversight, as if in the haste of her work she could not tell how to make that body exactly fit for that office to which she intended it ‡.

It is likely then that she had some other end which moved her to produce this variety; and this, in all probability, was her intent, to make it a fit body for habitation, with the same conveniences of sea and land, as this inferior world doth partake of. For since the moon is such a

* Albert. mag. de Cœvis. Q. 4. Art. 21. Colleg. Con.
† De somniis. ‡ Scalig. exercit. 62.

vast, such a solid and opacous body, like our earth (as was above proved) why may it not be probable that those thinner and thicker parts appearing in her, do shew the difference betwixt the sea and land in that other world? And Galilæus doubts not, but that if our earth were visible at the same distance, there would be the like appearance of it.

If we consider the moon as another habitable earth, then the appearances of it will be altogether exact and beautiful, and may argue unto us that it is fully accomplished for all those ends to which Providence did appoint it. But consider it barely as a star or light, and then there will appear in it much imperfection and deformity, as being of an impure dark substance, and so unfit for the office of that nature.

As for the form of those spots, some of the vulgar think they represent a man, and the poets guess it is the boy Endymion, whose company she loves so well, that she carries him with her: others will have it only to be the face of a man, as the moon is usually pictured; but Albertus thinks rather, that it represents a lion with his tail towards the east, and his head the west; and some others * have thought it to be very much like a fox; and certainly it is as much like a lion as that in the zodiac, or as ursa major is like a bear.

I should guess that it represents one of these as well as another, and any thing else as well as any of these, since it is but a strong imagination which fancies such images, as school-boys usually do in the marks of a wall, whereas there is not any similitude in the spots themselves, which rather like our sea, in respect of the land, appears under a rugged and confused figure, and doth not represent any distinct image: so that both in respect of the matter and the form, it may be probable enough that those spots and brighter parts may shew the distinction betwixt the sea and land in that other world.

* Eusebius Nieremb. Hist. Nat. l. 8. c. 15.

PROP. VIII.

The spots represent the sea, and the brighter parts the land.

WHEN I first compared the nature of our earth and water with those appearances in the moon, I concluded contrary to the proposition, that the brighter parts represented the water, and the spots the land. Of this opinion likewise was Keplar at the first *. But my second thoughts, and the reading of others, have now convinced me (as after he was) of the truth of that proposition which I have now set down. Before I come to the confirmation of it, I shall mention those scruples which at first made me doubt the truth of this opinion.

1. It may be objected, it is probable, if there be any such sea and land as ours, that it bears some proportion and similitude with ours: but now this proposition takes away all likeness betwixt them. For whereas the superficies of our earth is but the third part of the whole surface in the globe, two parts being overspread with the water (as Scaliger observes †), yet here, according to this opinion, the sea should be less than the land, since there is not so much of the bespotted as there is of the enlightened parts; wherefore it is probable that there is no such thing at all, or else that the brighter parts are the sea.

2. The water, by reason of the smoothness of its superficies, seems better able to reflect the sun-beams than the earth, which in most places is so full of ruggedness, of grass and trees, and such like impediments of reflection; and besides, common experience shews that the water shines with a greater and more glorious brightness than the earth; therefore it should seem that the spots are the earth, and

* Opt. Astro. c. 6. num. 9. Dissert. cum nuncio Gal.

† Exercit. 38.

the brighter parts the water. But to the first it may be answered.

1. There is no great probability in this consequence, that because it is so with us, therefore it must be so with the parts of the moon; for since there is such a difference betwixt them in divers other respects, they may not perhaps agree in this.

2. That assertion of Scaliger * is not by all granted for a truth. Fromondus with others think that the superficies of the sea and land, in so much of the world as is already discovered, is equal and of the same extension.

3. The orb of thick and vaporous air which encompasses the moon, makes the brighter parts of that planet appear bigger than in themselves they are; as I shall shew afterwards.

To the second it may be answered, That though the water be of a smooth superficies, and so may seem most fit to reverberate the light, yet because it is of a perspicuous nature, therefore the beams must sink into it, and cannot so strongly and clearly be reflected. *Sicut in speculo ubi plumbum abrasum fuerit* (saith Cardan), as in looking-glasses, where part of the lead is razed off, and nothing left behind to reverberate the image, the species must there pass through, and not back again: so it is where the beams penetrate and sink into the substance of the body, there cannot be such an immediate and strong reflection, as when they are beat back from the superficies; and therefore the sun causes a greater heat by far upon the land, than upon the water. Now as for that experiment, where it is said, that the waters have a greater brightness than the land; I answer, It is true only there where they represent the image of the sun, or some bright cloud, and not in other places; especially if we look upon them at any great distance, as is very plain by common observation.

And it is certain, that from any high mountain the land does appear a great deal brighter than any lake or river.

* De Meteoris, l. 5. c. 1. Art. 1.

This may yet be farther illustrated by the similitude of a looking-glass hanging upon a wall in the sun-shine; where, if the eye be not placed in the just line of reflection from the glass, it is manifest that the wall will be of a brighter appearance than the glass. True indeed, in the line of reflection, the light of the glass is equal almost unto that which comes immediately from the sun itself; but now this is only in one particular place, and so is not like that brightness which we discern in the moon; because this does appear equally in several situations, like that of the wall, which does seem bright as well from every place, as from any one. And therefore the roughness of the wall, or (as it is in the objection) the ruggedness of our earth, is so far from being an hindrance of such a reflection as there is from the moon, that it is rather required as a necessary condition unto it. We may conceive that in every rough body, there are, as it were, innumerable superficies, disposed unto an innumerable diversity of inclinations. *Ita ut nullus sit locus, ad quem non pertingant plurimi radii reflexi a plurimis superficieculis, per omnem corporis scabri radiis luminosis percussi superficiem dispersis**. "So that "there is not any place unto which there are not some "beams reflected from these diverse superficies, in the "several parts of such a rugged body." But yet (as I said before) the earth does receive a great part of its light by illumination, as well as by reflection.

So that notwithstanding those doubts, yet this proposition may remain true, That the spots may be the sea, and the brighter parts the land. Of this opinion was Plutarch†: unto him assented Keplar and Galilæus, whose words are these: *Si quis veterum Pythagoreorum sententiam exsuscitare velit, lunam scilicet esse quasi tellurem alteram ejus pars lucidior terrenam superficiem, obscurior vero aqueam magis congruè repræsentet. Mihi autem dubium fuit nunquam terrestris globi à longe conspecti, atque a radiis sola-*

* Galilæus System. Coll. 1.

† De facie Lun. Dissertatio Nunc. Syd.

ribus perfusi, terream superficiem clariorem, obscuriorem vero aqueam sese in conspectum daturam. "If any man "have a mind to renew the opinion of the Pythagoreans, "That the moon is another earth; then her brighter parts "may fitly represent the earth's superficies, and the darker "part the water: and for my part, I never doubted but "that our earthly globe being shined upon by the sun, and "beheld at a great distance, the land would appear bright-"est, and the sea more obscurely." The reasons may be,

1. That which I urged about the foregoing chapter; because the water is the thinner part, and therefore must give less light.

Since the stars and planets, by reason of their brightness, are usually concluded to be the thicker parts of their orb.

2. Water is in itself of a blacker colour (saith Aristotle*), and therefore more remote from light than the earth. Any part of the ground being moistened with rain, does look much more darkly than when it is dry.

3. It is observed that the secondary light of the moon (which afterwards is proved to proceed from our earth) is sensibly brighter unto us, for two or three days before the conjunction, in the morning when she appears eastward, than about the same time after the conjunction, when she is seen in the west. The reason of which must be this, because that part of the earth which is opposite to the moon in the east, has more land in it than sea. Whereas on the contrary, the moon when she is in the west, is shined upon by that part of our earth where there is more sea than land; from whence it will follow with good probability, that the earth does cast a greater light than the water.

4. Because observation tells us, that the spotted parts are always smooth and equal, having everywhere an equality of light, when once they are enlightened by the sun; whereas the brighter parts are full of rugged gibbosities

* In lib. de coloribus.

and mountains, having many shades in them, as I shall shew more at large afterwards.

That in this planet there must be seas, Campanella * endeavours to prove out of Scripture, interpreting the waters above the firmament, spoken in Genesis, to be meant of the sea in this world. For (saith he) it is not likely that there are any such waters above the orbs to moderate that heat which they receive from their swift motion (as some of the fathers think). Nor did Moses mean the angels, which may be called spiritual waters, as Origen and Austin† would have it, for both these are rejected by the general consent: nor could he mean any waters in the second region, as most commentators interpret it. For first there is nothing but vapours, which though they are afterwards turned into water, yet while they remain there, they are only the matter of that element, which may as well be fire, or earth, or air. 2. Those vapours are not above the expansum, but in it. So that he thinks there is no other way to salve all, but by making the planets several worlds with sea and land, with such rivers and springs as we have here below: especially since Esdras speaks of the springs above the firmament‡. But I cannot agree with him in this, nor do I think that any such thing can be proved out of scripture.

Before I proceed to the next position, I shall first answer some doubts which might be made against the generality of this truth, whereby it may seem impossible that there should be either sea or land in the moon: for since she moves so swiftly as astronomers observe, why then does there nothing fall from her, or why doth she not shake something out by the celerity of her revolution? I answer, You must know that the inclination of every heavy body to its proper centre, doth sufficiently tie it unto its place; so that suppose any thing were separated, yet must it ne-

* Apologia pro Galilæo.

† Vide Ieron. Epist. ad Pammachium. Confession. l. 13. c. 32. Retracted lib. 2. Retr. cap. 6.

‡ 2 Esdr. iv. 7.

cessarily return again. And there is no more danger of their falling into our world, than there is fear of our falling into the moon.

But yet there are many fabulous relations of such things as have dropped thence *. There is a tale of the Nemean lion that Hercules slew, which first rushing among the herds out of his unknown den in the mountain of Cytheron in Bœotia, the credulous people thought he was sent from their goddess the moon. And if a whirlwind did chance to snatch any thing up, and afterwards rain it down again, the ignorant multitude were apt to believe that it dropt from heaven. Thus Avicenna relates the story of a calf which fell down in a storm, the beholders thinking it a moon-calf, and that it fell thence. So Cardan travelling upon the Apennine mountains, a sudden blast took off his hat, which if it had been carried far, he thinks the peasants, who had perceived it to fall, would have sworn it had rained hats. After some such manner many of our prodigies come to pass, and the people are willing to believe any thing which they may relate to others as a very strange and wonderful event. I doubt not but the Trojan Palladium, the Roman Minerva, and our lady's church at Loretto, with many sacred relics preserved by the papists, might drop from the moon as well as any of these.

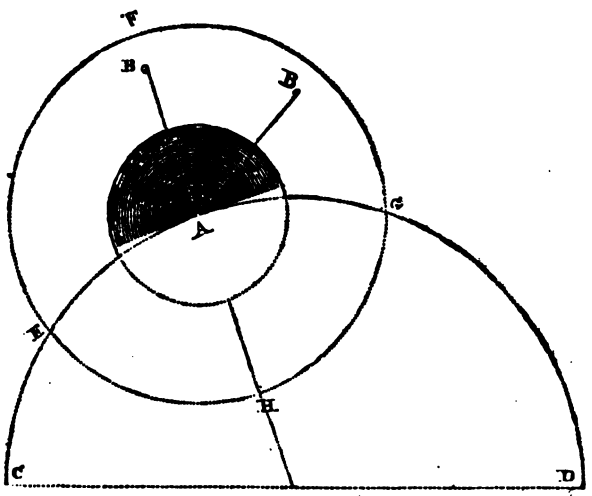
But it may be again objected, Suppose there were a bullet shot up in that world, would not the moon run away from it before it could fall down, since the motion of her body (being every day round our earth) is far swifter than the other, and so the bullet must be left behind, and at length fall down to us? To this I answer,

1. If a bullet could be shot so far till it came to the circumference of those things which belong to our centre, then it would fall down to us.

2. Though there were some heavy body a great height in that air, yet would the motion of that magnetical globe to which it did belong, by an attractive virtue still hold it within its convenient distance, so that whether their earth

* Vide Guli. Nubrigens. de rebus Anglica. lib. 1.

moved or stood still, yet would the same violence cast a body from it equally far. That I may the plainer express my meaning, I will set down this diagram.



Suppose this earth were A, which was to move in the circle C, D, and let the bullet be supposed at B, within its proper verge; I say, whether this earth did stand still, or move swiftly towards D, yet the bullet would still keep at the same distance, by reason of that magnetic virtue of the centre (if I may so speak) whereby all things within its sphere are attracted with it. So that the violence to the bullet, being nothing else but that whereby it is removed from its centre, therefore an equal violence can carry a body from its proper place but at an equal distance, whether or no this earth where its centre is, does stand still or move.

The impartial reader may find sufficient satisfaction for this and such other arguments as may be urged against the motion of that earth, in the writings of Copernicus and his followers; unto whom, for brevity sake, I will refer them.

PROP. IX.

That there are high mountains, deep vallies, and spacious plains in the body of the Moon.

THOUGH there are some who think mountains to be a deformity to the earth, as if they were either beat up by the flood, or else cast up like so many heaps of rubbish left at the creation; yet if well considered, they will be found as much to conduce to the beauty and conveniency of the universe, as any of the other parts. Nature (saith Pliny*) purposely framed them for many excellent uses; partly to tame the violence of greater rivers, to strengthen certain joints within the veins and bowels of the earth, to break the force of the sea's inundation, and for the safety of the earth's inhabitants, whether beasts or men. That they make much for the protection of beasts, the Psalmist testifies†; The highest hills are a refuge for the wild goats, and the rocks for conies. The kingly prophet had likewise learned the safety of these by his own experience, when he also was fain to make a mountain his refuge from the fury of his master Saul, who persecuted him in the wilderness.

True indeed, such places as these keep their neighbours poor, as being most barren, but yet they preserve them safe, as being most strong; witness our unconquered Wales and Scotland, whose greatest protection hath been the natural strength of their country; so fortified with mountains, that these have always been unto them sure retreats from the violence and oppression of others. Wherefore a good author doth rightly call them nature's bulwarks, cast up at God Almighty's own charges, the scorns and curbs of victorious armies. Which made the Barbarians in Curtius so confident of their own safety, when they

* Nat. Hist. l. 36. c. 5. † Psal. civ. ver. 18.

were once retired to an inaccessible mountain; that when Alexander's legate had brought them to a parley, and persuading them to yield, told them of his master's victories, what seas and wildernesses he had passed; they replied, that all that might be, but could Alexander fly too? Over the seas he might have ships, and over the land horses, but he must have wings before he could get up thither. Such safety did those barbarous nations conceive in the mountains whereunto they were retired. Certainly then such useful parts were not the effect of man's sin, or produced by the world's curse, the flood; but rather at the first created by the goodness and providence of the Almighty.

This truth is usually concluded from these and the like arguments.

1. Because the scripture itself, in the description of that general deluge, tells us, it overflowed the highest mountains.

2. Because Moses who writ long after the flood, does yet give the same description of places and rivers, as they had before; which could not well have been if this had made so strange an alteration.

3. It is evident that the trees did stand as before. For otherwise, Noah could not so well have concluded, that the waters were abated, from this reason, because the dove brought an olive leaf in her mouth, when she was sent forth a second time: whereas had the trees been rooted up, she might have taken it the first time, from one of them as it was floating on the top of the waters. Now if the motion of the water was not so violent as to subvert the trees, much less was it able to cast up such vast heaps as the mountains.

4. When the scripture doth set forth unto us the power and immensity of God by the variety or usefulness of the creatures which he hath made; amongst the rest it doth often mention the mountains. Psal. civ. 8. item, cviii. 9 Isa. xl. 12. And therefore it is probable they were created at the first. Unto this I might add that in other places,

divine wisdom in shewing of its own antiquity; saith that he was from the beginning, before the earth or the mountains were brought forth *.

5. If we may trust the relations of antiquity †, there were many monuments left undefaced after the flood.

So that if I intend to prove that the moon is such a habitable world as this is; it is requisite that I shew it to have the same conveniences of habitation as this hath. And here if some Rabbi or Chymic were to handle the point, they would first prove it out of scripture, from that place in Moses his blessing, where he speaks of the ancient mountains and lasting hills, Deut. 33. תרדי קדם ונבעות עולם for having immediately before mentioned those blessings which should happen unto Joseph by the influence of the moon, he does presently exegetically iterate them, in blessing him with the chief things of the ancient mountains and lasting hills; you may also see the same expression used in Jacob's blessing of Joseph ‡.

But however we may deal *pro* or *con* in philosophy, yet we must not be too bold with divine truths, or bring scripture to patronize any fancy of our own; though, (perhaps) it be a truth. I am not of their mind, who think it a good course to confirm philosophical secrets from the letter of the scripture, or by abusing some obscure text in it. Methinks it favours too much of that melancholy humour of the chymics, who, aiming in all their studies at the making of gold, do persuade themselves, that the most learned and subtile of the ancient authors, in all their obscure places do mean some such sense as may make to their purpose. And hence it is that they derive such strange mysteries from the fables of the poets; and can tell you what great secret it was, that antiquity did hide under the fiction of Jupiter being turned into a shower of gold: of Mercury's being made the interpreter of the Gods: of the Moon's descending to the earth for the love

* Prov. viii. 25. Psal. xc. 2. † Joseph. Ant. l. 1. cap. 3.
‡ Gen. xlix. 26.

of Endymion: with such ridiculous interpretations of these and the like fables, which any reasonable considering man cannot conceive to proceed from any but such as are distracted. No less fantastical in this kind are the Jewish Rabbies; amongst whom, is not any opinion, whether in nature or policy, whether true or false, but some of them, by a cabalistical interpretation can father it upon a dark place of scripture, or (if need be) upon a text that is clean contrary. There being not any absurdity so gross and incredible, for which these abusers of the text, will not find out an argument. Whereas, it is the more natural way, and should be observed in all controversies, to apply unto every thing the proper proofs of it; and when we deal with philosophical truths, to keep ourselves within the bounds of human reason and authority.

But this by the way. For the better proof of this proposition, I might here cite the testimony of Diodorus, who thought the moon to be full of rugged places, *velut terrestribus tumulis superciliosam;* but he erred much in some circumstances of this opinion, especially where he says, there is an island amongst the Hyperboreans, wherein those hills may to the eye be plainly discovered; and for this reason Cælius* calls him a fabulous writer. But you may see more express authority for the proof of this in the opinions of Anaxagoras and Democritus†, who held that this planet was full of champion grounds, mountains and vallies. And this seemed likewise probable unto Augustinus Nisus‡, whose words are these: *Forsitan non est remotum dicere lunæ partes esse diversas, veluti sunt partes terræ, quarum aliæ sunt vallosæ, aliæ montosæ, ex quarum differentia effici potest facies illa lunæ, nec est rationi dissonum, nam luna est corpus imperfecte sphæricum, cum sit corpus ab ultimo cœlo elongatum, ut supra dixit Aristoteles.* "Perhaps, it would not be amiss to say that the "parts of the moon were divers, as the parts of this

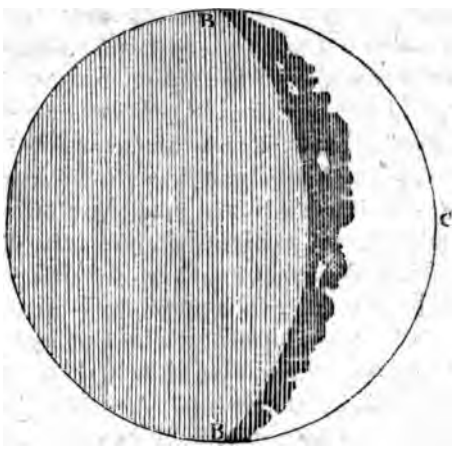
* Lect. aut. l. 1. c. 15.
† Plut. de plac. l. 2. c. 25.
‡ De Cœlo. l. 2. part. 49.

" earth, whereof some are vallies, and some mountains; " from the difference of which, some spots in the moon " may proceed; nor is this against reason; for that pla- " net cannot be perfectly spherical, since it is so remote a " body from the first orb, as Aristotle had said before." You may see this truth assented unto by Blancanus the Jesuit*, and by him confirmed with divers reasons. Keplar hath observed in the moon's eclipses, that the division of her enlightened part from the shaded, was made by a crooked unequal line †, of which there cannot be any probable cause conceived, unless it did arise from the ruggedness of that planet; for it cannot at all be produced from the shade of any mountains here upon earth; because these would be so lessened before they could reach so high in a conical shadow, that they would not be at all sensible unto us (as might easily be demonstrated); nor can it be conceived what reason of this difference there should be in the sun. Wherefore there being no other body that hath any thing to do in eclipses, we must necessarily conclude, that it is caused by a variety of parts in the moon itself; and what can these be but its gibbosities? now if you should ask a reason why there should be such a multitude of these in that planet, the same Keplar shall jest you out an answer. Supposing (saith he) that those inhabitants are bigger than any of us, in the same proportion as their days are longer than ours, viz. by fifteen times; it may be, for want of stones to erect such vast houses as were requisite for their bodies, they are fain to dig great and round hollows in the earth ‡, where they may both procure water for their thirst, and turning about with the shade, may avoid those great heats which otherwise they would be liable unto. Or if you will give Cæsar la Galla leave to guess in the same manner, he would rather think that those thirsty nations cast up so many and so

* De Mundi fab. par. 3. c. 4. † Astron. Opt. c. 6. num. 9.
‡ Kep. appen. Selenogra.

great heaps of earth in digging of their wine cellars; but this only by the way.

I shall next produce the eye-witness of Galilæus*, on which I most of all depend for the proof of this proposition; when he beheld the new moon through his perspective, it appeared to him under a rugged and spotted figure, seeming to have the darker and enlightened parts divided by a tortuous line, having some parcels of light at a good distance from the other; and this difference is so remarkable, that you may easily perceive it through one of those ordinary perspectives, which are commonly sold amongst us; but for your better apprehending of what I deliver, I will set down the figure as I find it in Galilæus.



Suppose *B C B* to represent the appearance of the Moon's body being in a sextile, you may see some brighter parts separated at a pretty distance from the other, which can be nothing else but a reflection of the sun-beams upon some parts that are higher than the rest; and those obscure gibbosities which stand out towards the enlightened parts,

* Nuncius Sydereus.

must be such hollow and deep places whereto the rays cannot reach. But when the moon is got farther off from the sun, and come to that fulness as this line *B B* doth represent her under; then do these parts also receive an equal light, excepting only that difference which doth appear betwixt their sea and land. And if you do consider how any rugged body would appear being enlightened, you would easily conceive that it must necessarily seem under some such gibbous unequal form, as the moon is here represented. Now for the infallibility of these appearances, I shall refer the reader to that which hath been said in the sixth proposition.

But Cæsar la Galla affirms, that all these appearances may consist with a plain superficies, if we suppose the parts of the body to be some of them diaphanous, and some opacous; and if you object that the light which is conveyed to any diaphanous part in a plain superficies, must be by a continued line; whereas here there appear many brighter parts among the obscure at some distance from the rest: to this he answers, it may rise from some secret conveyances and channels within her body, that do consist of a more diaphanous matter; which being covered over with an opacous superficies, the light passing through them may break out a great way off; whereas the other parts betwixt, may still remain dark. Just as the river Arethusa in Sicily, which runs under ground for a great way, and afterwards breaks out again. But, because this is one of the chiefest fancies, whereby he thinks he hath fully answered the argument of this opinion, I will therefore set down his answer in his own words, lest the reader might suspect more in them than I have expressed *. *Non est impossibile cæcos ductus diaphani & perspicui corporis, sed opaca superficie protendi, usque in diaphanam aliquam ex profundo in superficiem emergentem partem, per quos ductus lumen longo postmodum interstitio erumpat, &c.* But I reply, if the superficies betwixt these two

* Cap. 11.

two enlightened parts remain dark because of its opacity; then would it always be dark, and the sun could not make it partake of light more than it could of perspicuity. But this contradicts all experience, as you may see in Galilæus, who affirms that when the sun comes nearer to his opposition, then that which is betwixt them both, is enlightened as well as either. Nay, this opposes his own eye-witness; for he confesses himself that he saw this by the glass. He had said before, that he came to see those strange sights discovered by Galilæus his glass, with an intent of contradiction; and you may read that confirmed in the weakness of this answer, which rather bewrays an obstinate, than a persuaded will; for otherwise sure he would never have undertook to have destroyed such certain proof with so groundless a fancy.

That instance of Galilæus*, would have been a better evasion, had this author been acquainted with it; who might then have compared the moon to that which we call mother of pearl, which though it be most exactly polished in the superficies of it, yet will seem unto the eye as if there were divers swellings and risings in its several parts. But yet, this neither would not well have shifted the experiment of the perspective. For these rugged parts do not only appear upon one side of the moon, but as the sun does turn about in divers places, so do they also cast their shadow. When the moon is in her increase, then do they cast their shadows to the east. When she is in the decrease, and the sun on the other side of her, then likewise may we discover these brighter parts casting their shadows westward. Whereas in the full moon there are none of all these to be seen.

But it may be objected, that it is almost impossible, and altogether unlikely, that in the moon there should be any mountains so high as those observations make them. For do but suppose, according to the common principles, that the moon's diameter unto the earth's, is very near to the

* Syst. mund. col. 1.

proportion of two to seven. Suppose withal that the earth's diameter contains about 7000 Italian miles, and the moon's 2000 (as is commonly granted.) Now Galilæus hath observed, that some parts have been enlightened, when they were the twentieth part of the diameter distant from the common term of illumination. From whence it must necessarily follow, that there may be some mountains in the moon so high, that they are able to cast a shadow a hundred miles off. An opinion that sounds like a prodigy or a fiction; wherefore it is likely that either those appearances are caused by somewhat else besides mountains, or else those are fallible observations; from whence may follow such improbable, inconceivable consequences.

But to this I answer;

1. You must consider the height of the mountains is but very little, if you compare them to the length of their shadows. Sir Walter Rawleigh* observes that the mount Athos, now called Lacas, casts its shadow 300 furlongs, which is above 37 miles; and yet that mount is none of the highest. Nay Solinus † (whom I should rather believe in this kind) affirms that this mountain gives his shadow quite over the sea, from Macedon to the isle of Lemnos, which is 700 furlongs, or 84 miles, and yet according to the common reckoning it doth scarce reach 4 miles upwards in its perpendicular height.

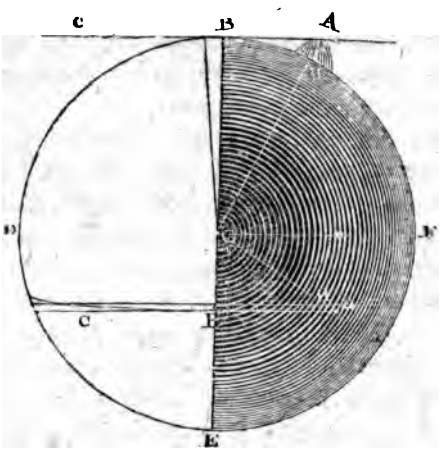
2. I affirm that there are very high mountains in the moon. Keplar and Galilæus think that they are higher than any which are upon our earth. But I am not of their opinion in this, because I suppose they go upon a false ground, whilst they conceive that the highest mountain upon the earth is not above a mile perpendicular.

Whereas it is the common opinion, and found true enough by observation, that Olympus, Atlas, Taurus and Emus, with many others, are much above this height. Tenariffa, in the Canary islands, is commonly related to be above 8 miles perpendicular, and about this height (say

* Hist. l. 1. cap. 7. sect. 11. † Poly. Hist. c. 21.

some) is the mount Perjacaca in America. Sir Walter Rawleigh* seems to think that the highest of these is near 30 miles upright: nay Aristotle, speaking of Caucasus in Asia, affirms it to be visible for 500 miles, as some interpreters find by computation; from which it will follow, that it was 78 miles perpendicularly high; as you may see confirmed by Jacobus Mazonius †, and out of him in Blancanus the Jesuit. But this deviates from the truth more in excess than the other doth in defect. However, though these in the moon are not so high as some amongst us; yet certain it is they are of a great height, and some of them at the least four miles perpendicular. This I shall prove from the observation of Galilæus, whose glass can shew to the senses a proof beyond exception; and certainly that man must needs be of a most timorous faith, who dares not believe his own eye.

By that perspective you may plainly discern some enlightened parts (which are the mountains) to be distant from the other about the twentieth part of the diameter. From whence it will follow, that those mountains must necessarily be at the least four Italian miles in height.



* Hist. l. 1. c. 7. sect. 11. Meteor. l. 1. c. 11.

† Comparatio Arist. cum. Platone, sect. 3. c. 5. Expost. in loc. Matth. Arlis loc. 148.

For let B D E F be the body of the moon, A B C will be a ray or beam of the sun, which enlightens a mountain at A, and B is the point of contingency; the distance betwixt A and B must be supposed to be the twentieth part of the diameter, which is an 100 miles, for so far are some enlightened parts severed from the common term of illumination. Now the aggregate of the quadrate from A B a hundred, and B G 1000 will be 1010000; unto which the quadrate arising from A G must be equal; according to the 47th proposition in the first book of elements. Therefore the whole line A G is somewhat more than 104, and the distance betwixt H A must be above 4 miles, which was the thing to be proved.

But it may be again objected, if there be such rugged parts, and so high mountains, why then cannot we discern them at this distance? Why doth the moon appear unto us so exactly round, and not rather as a wheel with teeth?

I answer, by reason of too great a distance; for if the whole body appears to our eye so little, then those parts which bear so small a proportion to the whole, will not at all be sensible.

But it may be replied, if there were any such remarkable hills, why does not the limb of the moon appear like a wheel with teeth, to those who look upon it through the great perspective, on whose witness you so much depend? Or what reason is there that she appears as exactly round through it, as she doth to the bare eye? certainly then either there is no such thing as you imagine, or else the glass fails much in this discovery.

To this I shall answer out of Galilæus.

1. You must know, that there is not merely one rank of mountains above the edge of the moon, but divers orders, one mountain behind another, and so there is somewhat to hinder those void spaces which otherwise, perhaps, might appear.

Now where there be many hills, the ground seems even to a man that can see the tops of all. Thus when the sea

rages, and many vast waves are lifted up, yet all may appear plain enough to one that stands at the shore. So where there are so many hills, the inequality will be less remarkable if it be discerned at a distance.

2. Though there be mountains in that part which appears unto us to be the limb of the moon, as well as in any other place, yet the bright vapours hide their appearance; for there is an orb of thick vaporous air that doth immediately compass the body of the moon; which though it have not so great opacity, as to terminate the sight, yet being once enlightened by the sun, it doth represent the body of the moon under a greater form, and hinders our sight from a distinct view of her true circumference. But of this in the next chapter.

3. Keplar hath observed*, that in the solary eclipses, when the rays may pass through this vaporous air, there are some gibbosities to be discerned in the limb of the moon.

I have now sufficiently proved, that there are hills in the moon; and hence it may seem likely that there is also a world: for since providence hath some special end in all its works, certainly then these mountains were not produced in vain; and what more probable meaning can we conceive there should be, than to make that place convenient for habitation.

* Somn. Astr. not. 207.

PROP. X.

That there is an Atmo-sphæra, or an orb of gross, vaporous air immediately encompassing the body of the Moon.

AS that part of our air which is nearest to the earth is of a thicker substance than the other, by reason it is always mixed with some vapours which are continually exhaled into it; so is it equally requisite, that if there be a world in the moon, that the air about that should be alike qualified with ours. Now that there is such an orb of gross air, was first of all (for ought I can read) observed by Meslin *, afterwards assented unto by Keplar and Galilæus, and since by Baptista Cittacus, Scheiner, with others, all of them confirming it by the same arguments; which I shall only cite, and then leave this proposition.

1. It is not improbable that there should be a sphere of grosser air about the moon; because it is observed that there are such kind of evaporations which proceed from the sun itself. For there are discovered divers moveable spots, like clouds, that do encompass his body; which those authors who have been most frequently versed in these kind of experiments and studies, do conclude to be nothing else but evaporations from it. The probability and truth of which observations may also be inferred from some other appearances. As,

1. It hath been observed that the sun hath sometimes for the space of four days together †, appeared as dull and ruddy almost as the moon in her eclipses, insomuch that the stars have been seen at mid-day. Nay, he hath been constantly darkened for almost a whole year, and never shined but with a kind of heavy and duskish light, so that

* Vide Euseb. Nicrem. de Nat. Hist. l. 2. c. 11.

† So A. D. 1547, April 24th to the 28th.

there was scarce heat enough to ripen the fruits. As it was about the time when Cæsar was killed. Which was recorded by some of the poets. Thus Virgil speaking of the sun.

Ille etiam extincto miseratus Cæsare Romam,
Cum caput obscura nitidum ferrugine texit,
*Impiaque æternam timuerunt sæcula noctem**.

He pitying Rome when as great Cæsar dy'd,
His head within a mourning vail did hide.
And thus the wicked guilty world did fright
With doubtful fears of an eternal night.

Ovid likewise, speaking of his death,

——— *Solis quoque tristis imago*
Lurida sollicitis præbebat lumina terris. †

——— The sun's sad image then
Did yield a lowering light to fearful men.

Now these appearances could not arise from any lower vapour: for then, 1. They would not have been so universal as they were, being seen through all Europe: or else, 2. That vapour must have covered the stars as well as the sun, which yet notwithstanding were then plainly discerned in the day-time. You may see this argument illustrated in another the like case, chap. 12. Hence then it will follow, that this fuliginous matter, which did thus obscure the sun, must needs be very near his body; and if so, then what can we more probably guess it to be than evaporations from it?

2. It is observed, that in the sun's total eclipses, when there is no part of his body discernible, yet there does not always follow so great a darkness as might be expected from his total absence. Now it is probable that the reason is, because these thicker vapours being enlightened by his beams, do convey some light unto us, notwithstanding the interposition of the moon betwixt his body and our earth.

* Virgil, Georg. l. 1. † Metam. lib. 15.

3. This likewise is by some guessed to be the reason of the *crepusculum*, or that light which we have before the sun's rising.

Now if there be such evaporations from the sun, much more then from the moon, which does consist of a more gross and impure substance. The other arguments are taken from several observations in the moon herself, and do more directly tend to the proof of this proposition.

2. It is observed, that so much of the moon as is enlightened, is always part of a bigger circle than that which is darker. The frequent experience of others hath proved this, and an easy observation may quickly confirm it. But now this cannot proceed from any other cause so probable as from this orb of air; especially when we consider how that planet shining with a borrowed light, doth not send forth any such rays as may make her appearance bigger than her body.

3. When the moon being half enlightened, begins to cover any star, if the star be towards the obscurer part, then may it by the perspective be discerned to be nearer unto the center of the moon than the outward circumference of the enlightened part. But the moon being in the full, then does it seem to receive these stars without its limb.

4. Though the moon do sometime appear the first day of her change, when so much as appears enlightened cannot be above the 80th part of her diameter, yet then will the horns seem at least to be of a finger's breadth in extension; which could not be, unless the air about it were illuminated.

5. It is observed in the solary eclipses, that there is sometimes a great trepidation about the body of the moon, from which we may likewise argue an atmosphæra, since we cannot well conceive what so probable a cause there should be of such an appearance as this, *Quod radii solares a vaporibus lunam ambientibus fuerint intercisi**, that the

* Scheiner Ros. Urs. l. 4. part. 2. c. 27.

sun-beams were broken and refracted by the vapours that encompassed the moon.

6. I may add the like argument taken from another observation which will be easily tried and granted. When the sun is eclipsed, we discern the moon as she is in her own natural bigness; but then she appears somewhat less than when she is in the full, though she be in the same place of her supposed excentrick and epicycle; and therefore Tycho hath calculated a table for the diameter of the divers new moons. But now there is no reason so probable to solve this appearance, as to place an orb of thicker air near the body of that planet, which may be enlightened by the reflected beams, and through which the direct rays may easily penetrate.

But some may object, that this will not consist with that which was before delivered, where I said, that the thinnest parts had least light.

If this were true, how comes it to pass then that this air should be as light as any of the other parts, when as it is the thinnest of all?

I answer, if the light be received by reflection only, then the thickest body hath most, because it is best able to beat back the rays; but if the light be received by illumination (especially if there be an opacous body behind, which may double the beams by reflexion) as it is here, then I deny not but a thin body may retain much light; and perhaps some of those appearances which we take for fiery comets, are nothing else but a bright cloud enlightened; so that probable it is there may be such air without the moon: and hence it comes to pass, that the greater spots are only visible towards her middle parts, and none near the circumference; not but that there are some as well in those parts as elsewhere, but they are not there perceiveable, by reason of those brighter vapours which hide them.

PROP. XI.

That as their World is our Moon, so our World is their Moon.

I Have already handled the first thing that I promised, according to the method which Aristotle uses in his book De Mundo; and shewed you the necessary parts that belong to this world in the moon. In the next place it is requisite that I proceed to those things which are extrinsical unto it, as the seasons, the meteors, and the inhabitants.

1. Of the seasons;

And if there be such a world in the moon, it is requisite then that their seasons should be some way correspondent unto ours, that they should have winter and summer, night and day, as we have.

Now that in this planet there is some similitude of winter and summer, is affirmed by Aristotle himself*; since there is one hemisphere that hath always heat and light and the other that hath darkness and cold. True indeed, their days and years are always of one and the same length; (unless we make one of their years to be 19† of ours, in which space all the stars do arise after the same order.) But it is so with us also under the poles, and therefore that great difference is not sufficient to make it altogether unlike ours; nor can we expect that every thing there should be in the same manner as it is here below, as if nature had no way but one to bring about her purposes. We have no reason then to think it necessary that both these worlds should be altogether alike; but it may suffice if they be correspondent in something only. However, it may be questioned whether it doth not seem to be against the wisdom of Providence, to make the night of so

* Degen. anima. l. 4. 12. † Golden number.

great a length, when they have such a long time unfit for work? I answer, no; since it is so, and more with us also under the poles; and besides, the general length of their night is somewhat abated in the bigness of their moon, which is our earth. For this returns as great a light unto that planet, as it receives from it. But for the better proof of this, I shall first free the way from such opinions as might otherwise hinder the speed of a clearer progress.

Plutarch, one of the chief patrons of this world in the moon*, doth directly contradict this proposition; affirming, that those who live there, may discern our world, as the dregs and sediment of all other creatures; appearing to them through clouds and foggy mists, and that altogether devoid of light, being base and unmoveable; so that they might well imagine the dark place of damnation to be here situate, and that they only were the inhabiters of the world, as being in the midst betwixt heaven and hell.

To this I may answer, it is probable that Plutarch spake this inconsiderately and without a reason; which makes him likewise fall into another absurdity, when he says our earth would appear immoveable; whereas questionless, though it did not, yet would it seem to move, and theirs to stand still, as the land doth to a man in a ship; according to that of the poet:

Provehimur portu, terræque, urbesque recedunt.

And I doubt not but that an ingenious author would easily have recanted, if he had been but acquainted with those experiences which men of later times have found out, for the confirmation of this truth.

2. Unto him assents Macrobius, whose words are these; *Terra accepto solis lumine clarescit tantummodo, non relucet*†. "The earth is by the sun-beams made bright, "but not able to enlighten any thing so far." And his reason is, because this being of a thick and gross matter,

* Plut. de fac. lunæ. † Somm. Scip. l. 1. c. 19.

the light is terminated in its superficies, and cannot penetrate into the substance; whereas the moon doth therefore seem so bright to us, because it receives the beams within itself. But the weakness of this assertion may be easily manifest by a common experience; for polished steel (whose opacity will not give any admittance to the rays) reflects a stronger heat than glass, and so consequently a greater light.

3. It is the general consent of philosophers, that the reflection of the sun-beams from the earth doth not reach much above half a mile high, where they terminate the first region; so that to affirm they might ascend to the moon, were to say, there were but one region of air, which contradicts the proved and received opinion.

Unto this it may be answered:

That it is indeed the common consent, that the reflection of the sun beams reach only to the second region; but yet some there are, and those too, philosophers of good note, who thought otherwise. Thus Plotinus is cited by Cælius, *Si concipias te in sublime quopiam mundi loco, unde oculis subjiciatur terræ moles aquis circumfusa, & solis syderumque radiis illustrata, non aliam profecto visam iri probabile est, quam qualis modo visatur lunaris globi species* *. "If you conceive yourself to be in some "such high place, where you might discern the whole "globe of the earth and water, when it was enlightened "by the sun's rays, it is probable it would then appear to "you in the same shape as the moon doth now unto us." So Paulus Foscarinus. *Terra nihil aliud est quam altera luna, vel stella, talisque nobis appareret, si ex convenienti elongatione eminus conspiciretur, in ipsaque observari possent eadem aspectuum varietates, quæ in Luna apparent* †. "The earth is nothing else but another moon or star, and "would appear so unto us if it were beheld at a conve-"nient distance, with the same changes and varieties as "there are in the moon." Thus also Carolus Malaper-

* Ant. lect. l. 1. c. 4.

† In ep. ad Sebast. fantonum.

tius, whose words are these: *Terra hæc nostra, si in lunâ constituti essemus, splendida prorsus quasi non ignobilis planeta, nobis appareret**. "If we were placed in the moon, "and from thence beheld this our earth, it would appear "unto us very bright, like one of the nobler planets." Unto these doth Fromondus assent, when he says, *Credo equidem quod si oculus quispiam in orbe lunari foret, globum terræ & aquæ instar ingentis syderis à sole illustrem conspiceret*†. "I believe that this globe of earth and water "would appear like some great star to any one, who "should look upon it from the moon." Now this could not be, nor could it shine so remarkably, unless the beams of light were reflected from it. And therefore the same *Fromondus* expressly holds, that the first region of air is there terminated, where the heat caused by reflection begins to languish, whereas the beams themselves do pass a great way further. The chief argument which doth most plainly manifest this truth, is taken from a common observation which may be easily tried.

If you behold the moon a little before or after the conjunction, when she is in a sextile with the sun, you may discern not only the part which is enlightened, but the rest also to have in it a kind of a duskish light; but if you chuse out such a situation, where some house or chimney (being some seventy or eighty paces distant from you) may hide from your eye the enlightened horns, you may then discern a greater and more remarkable shining in those parts unto which the sun-beams cannot reach; nay, there is so great a light, that by the help of a good perspective you may discern its spots. In so much that Blancanus the Jesuit speaking of it, says, *Hæc experientia ita me aliquando fefellit, ut in hunc fulgorem casu ac repente incidens, existimarim novo quodam miraculo tempore adolescentis lunæ factum esse plenilunium*‡. "This experiment "did once so deceive me, that happening upon the sight

* Præfat. ad Austriaca Syd. † Meteor. l. 1. c. 2. art. 2.
‡ De mundi fab. p. 3. c. 3.

" of this brightness upon a sudden, I thought that by some " new miracle the moon had been got into her full a little " after her change."

But now this light is not proper to the moon; it doth not proceed from the rays of the sun which doth penetrate her body, nor is it caused by any other of the planets and stars. Therefore it must necessarily follow, that it comes from the earth. The two first of these I have already proved, and as for the last, it is confidently affirmed by Cœlius, *Quod si in disquisitionem evocet quis, an lunari syderi lucem fœnerent planetæ item alii, asseverantur astruendum non fœnerare**. " If any should ask whether the " other planets lend any light to the moon? I answer, " they do not." True indeed, the noble Tycho discussing the reason of this light, attributes it to the planet Venus†; and I grant that this may convey some light, to the moon; but that it is not the cause of this whereof we now discourse, is of itself sufficiently plain; because Venus is sometimes over the moon, when as she cannot convey any light to that part which is turned from her.

It doth not proceed from the fixed stars; for then it would retain the same light in eclipses, whereas the light at such times is more ruddy and dull. Then also the light of the moon would not be greater or lesser, according to its distance from the edge of the earth's shadow, since it did at all times equally participate this light of the stars.

In brief, this is neither proper to the moon, nor does it proceed from any penetration of the sun's rays, or the shining of Venus, or the other planets, or the fixed stars. Now because there is no other body in the whole universe, save the earth, it remains that this light must necessarily be caused by that, which with a just gratitude repays to the moon such illumination as it receives from her.

And as loving friends equally participate of the same joy and grief, so do these mutually partake of the same light from the sun, and the same darkness from the eclipses,

* Ant Lect. l. 20. c. 5. † Progym. 1.

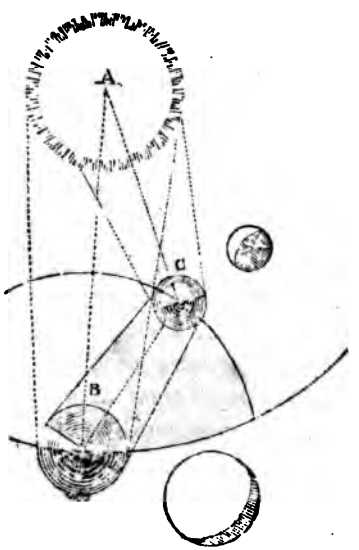
being also severally helped by one another in their greatest wants: for when the moon is in conjunction with the sun, and her upper part receives all the light, then her lower hemisphere (which would otherwise be altogether dark) is enlightened by the reflection of the sun-beams from the earth. When these two planets are in opposition, then that part of the earth which could not receive any light from the sun-beams, is most enlightened by the moon, being then in her full; and as she doth most illuminate the earth when the sun-beams cannot, so the grateful earth returns to her as great (nay greater) light when she most wants it; so that always that visible part of the moon which receives nothing from the sun, is enlightened by the earth, as is proved by Galilæus, with many more arguments, in that treatise which he calls Systema Mundi. True indeed, when the moon comes to a quartile, then you can neither discern this light; nor yet the darker part of her body; and that for a double reason;

1. Because the nearer it comes to the full, the less light does it receive from the earth, whose illumination does always decrease in the same proportion as the moon does increase.

2. Because of the exuberancy of the light in the other parts. *Quippe illustratum medium speciem recipit valentiorem**. The clearer brightness involves the weaker; it being with the species of sight, as it is with those of sound; and as the greater noise drowns the less, so the brighter object hides that which is more obscure. But as they do always in their mutual vicissitudes participate of one another's light: so also do they partake of the same defects and darkenings; for when our moon is eclipsed, then is their sun darkened; and when our sun is eclipsed, then is their moon deprived of its light, as you may see affirmed by Meslin†. *Quod si terrum nobis ex alto liceret intueri, quemadmodum deficientem lunam ex longinquo spectare possumus, videremus tempore eclipsis solis terræ aliquam*

* Scal. exerc. 62. † Epit. Astr. l. 4. part 2.

partem lumine solis deficere, eodem plane mode sicut ex opposito luna deficit. " If we might behold this globe of " earth at the same distance as we do the moon in her " defect, we might discern some part of it darkened in " the sun's eclipses, just so as the moon is in hers." For as our moon is eclipsed by the interposition of our earth, so is their moon eclipsed by the interposition of theirs. The manner of this mutual illumination betwixt these two you may plainly discern in this figure following.



Where *A* represents the sun, *B* the earth, and *C* the moon: Now suppose the moon *C* to be in a sextile of increase, when there is only one small part of her body enlightened, then the earth *B* will have such a part of its visible hemisphere darkened, as is proportionable to that part of the moon which is enlightened; and as for so much of the moon, as the sun-beams cannot reach unto, it re-

ceives light from a proportionable part of the earth which shines upon it, as you may plainly perceive by the figure.

You see then that agreement and similitude which there is betwixt our earth and the moon. Now the greatest difference which makes them unlike, is this, that the moon enlightens our earth round about, whereas our earth gives light only to that hemisphere of the moon which is visible unto us; as may be certainly gathered from the constant appearance of the same spots, which could not thus come to pass, if the moon had such a diurnal motion about its own axis as perhaps our earth hath. And though some suppose her to move in an epicycle, yet this doth not so turn her body round, that we may discern both hemispheres; for according to that hypothesis (say they) the motion of her eccentric doth turn her face towards us, as much as the other doth from us.

But now, if any question what they do for a moon, who live in the upper part of her body? I answer, The solving of this, is the most uncertain and difficult thing that I know of, concerning this whole matter. But yet unto me this seems a probable conjecture.

That the upper hemisphere of the moon doth receive a sufficient light from those planets about it; and amongst these, Venus (it may be) bestows a more especial brightness, since Galilæus hath plainly discerned that she suffers the same increases and decreases, as the moon hath; and it is probable that this may be perceived there, without the help of a glass, because they are far nearer it than we. When Venus (saith Keplar) lies down in the perige or lower part of her supposed epicycle, then is she in conjunction with her husband the sun; from whom, after she hath departed for the space of ten months, she gets *plenum uterum*, and is in the full.

But you will reply, though Venus may bestow some light when she is over the moon, and in conjunction, yet being in opposition, she is not visible to them, and what shall they then do for light?

I answer; then they have none; nor doth this make so great a difference betwixt those two hemispheres, as there is with us betwixt the places under the poles and the line. And besides, it is considerable that there are two kind of planets.

1. Primary; such whose proper circle do encompass the body of the Sun, whereof there are six; Saturn, Jupiter, Mars, Ceres or the Earth, Venus, Mercury. As in the frontispiece.

2. Secondary; such whose proper circles are not about the sun, but some of the other primary planets. Thus are there two about Saturn, four about Jupiter, and thus likewise does the moon encompass our earth. Now it is probable that these lesser secondary planets, are not so accommodated with all conveniencies of habitation, as the others that are more principal.

But it may seem a very difficult thing to conceive, how so gross and dark a body as our earth, should yield such a clear light as proceeds from the moon; and therefore the Cardinal de Cusa* (who thinks every star to be a several world) is of opinion, that the light of the sun is not able to make them appear so bright; but the reason of their shining is, because we behold them at a great distance through their regions of fire, which do set a shining lustre upon those bodies that of themselves are dark. *Unde si quis esset extra regionem ignis, terra ista in circumferentiâ suæ regionis per medium ignis lucida stella appareret.* "So that if a man were beyond the region of fire, this "earth would appear through that as a bright star." But if this were the only reason, then would the moon be freed from such increases and decreases, as she is now liable unto.

Keplar thinks that our earth receives that light whereby it shines, from the sun; but this (saith he) is not such an intended clear brightness as the moon is capable of, and therefore he guesses that the earth there is of a more

* De doct. ig. l. 2. c. 12.

chuaky soil, like the isle of Crete, and so is better able to reflect a stronger light; whereas our earth must supply this intention with the quantity of its body. But this I conceive to be a needless conjecture, since our earth (if all things were well considered) will be found able enough to reflect as great a light. For,

1. Consider its opacity; if you mark these sublunary things, you shall perceive that amongst them, those that are most perspicuous, are not so well able to reverberate the sun-beams, as the thicker bodies. The rays pass singly through a diaphanous matter, but in an opacous substance they are doubled in their return, and multiplied by reflection. Now if the moon and the other planets can shine so clearly by beating back the sun-beams, why may not the earth also shine as well, which agrees with them in the cause of this brightness, their opacity?

2. Consider what a clear light we may discern reflected from the earth in the midst of summer; and withal, conceive how much greater that must be which is under the line, where the rays are more directly and strongly reverberated.

3. It is considerable, that though the moon does in the night-time seem to be of so clear a brightness, yet when we look upon it in the day, it appears like some little whitish cloud: not but that at both times, she is of an equal light in herself. The reason of this difference is, because in the night we look upon it through a dark and obscure medium, there being no other enlightened body, whose brightness may abate from this: whereas in the day-time, the whole heavens round about it are of an equal clearness, and so make it to appear with a weaker light. Now because we cannot see how the enlightened parts of our earth do look in the night, therefore in comparing it with the moon, we must not consider her, as she is beheld through the advantage of a dark medium, but as she seems in the day-time. Now in any clear sunshine day, our earth does appear as bright as the moon, which at the same time does seem like some duskish cloud

(as any little observation may easily manifest.) Therefore we need not doubt but that the earth is as well able to give light as the moon. To this it may be added, that those very clouds, which in the day-time seem to be of an equal light to the moon, do in the evening become as dark as our earth; and as for those of them which are looked upon at any great distance, they are often mistaken for the mountains.

4. It is considerable, that though the moon seem to be of so great a brightness in the night, by reason of its nearness unto those several shadows which it casts, yet is it of itself weaker than that part of twilight, which usually we have for half an hour after sun-set, because we cannot till after that time discern any shadow to be made by it.

5. Consider the great distance at which we behold the planets, for this must needs add much to their shining; and therefore Cusanus (in the above-cited place) thinks that if a man were in the sun, that planet would not appear so bright to him, as now it doth to us, because then his eye could discern but little; whereas here, we may comprehend the beams as they are contracted in a narrow body. Keplar beholding the earth from a high mountain, when it was enlightened by the sun, confesses that it appeared unto him of an incredible brightness, whereas then he could only see some small parts of it; but how much brighter would it have appeared, if he might in a direct line behold the whole globe of earth and these rays gathered together? So that if we consider that great light which the earth receives from the sun in the summer, and then suppose we were in the moon, where we might see the whole earth hanging in those vast spaces, where there is nothing to terminate the sight, but those beams which are there contracted into a little compass; I say, if we do well consider this, we may easily conceive that our earth appears as bright to those other inhabitants in the moon, as theirs doth to us.

But here it may be objected, that with us for many days in the year, the heavens are so overclouded, that we

cannot see the sun at all; and for the most part, in our brightest days, there are many scattered clouds which shade the earth in sundry places: so that in this respect, it must needs be unlike the moon, and will not be able to yield so clear, unintermitted a light, as it receives from that planet.

To this I answer.

1. As for those lesser brighter clouds, which for the most part are scattered up and down in the clearest days, these can be no reason why our earth should be of a darker appearance, because these clouds being near unto the earth, and so not distinguishable at so great a distance from it; and likewise being illuminated on their back parts by the sun that shines upon them, must seem as bright to those in the moon, as if the beams were immediately reflected from our earth.

2. When these clouds that are interposed, are of any large extension, or great opacity, as it is in extraordinary lasting and great rains, then there must be some discernible alteration in the light of our earth: but yet this does not make it to differ from the moon, since it is so also with that planet, as is shewed in the latter part of the next chapter.

PROP. XII.

That it is probable there may be such meteors belonging to that world in the Moon, as there are with us.

PLUTARCH discussing on this point, affirms that it is not necessary there should be the same means of growth and fructifying in both these worlds, since nature might in her policy find out more ways than one how to bring about the same effect. But however, he thinks it is probable that the moon herself sendeth forth warm winds; and by the swiftness of her motion, there should breathe

out a sweet and comfortable air, pleasant dews, and gentle moisture, which might serve for refreshing and nourishment of the inhabitants and plants in that other world.

But since they have all things alike with us, as sea and land, and vaporous air encompassing both; I should rather therefore think, that nature there should use the same way of producing meteors as she doth with us; and not by a motion, (as Plutarch supposes) because she doth not love to vary from her usual operations without some extraordinary impediment, but still keeps her beaten path, unless she be driven thence.

One argument whereby I shall manifest this truth, may be taken from those new stars which have appeared in divers ages of the world, and by their paralax have been discerned to have been above the moon; such as was that in Cassiopeia, that in Sagittarius, with many others betwixt the planets. Hipparchus* in his time took especial notice of such as these, and therefore fancied out such constellations in which to place the stars, shewing how many there were in every asterism; that so afterwards, posterity might know whether there were any new star produced, or any old one missing. Now the nature of these comets may probably manifest, that in this other world there are other meteors also; for these in all likelihood, are nothing else but such evaporations caused by the sun from the bodies of the planets. I shall prove this by shewing the improbabilities and inconveniences of any other opinion.

For the better pursuit of this, it is in the first place requisite, that I deal with our chief adversary, Cæsar la Galla, who doth most directly oppose that truth which is here to be proved. He endeavouring to confirm the incorruptibility of the heavens, and being there to satisfy the argument which is taken from these comets; he answers it thus: *Aut argumentum desumptum ex paralaxi, non est efficax, aut si est efficax, eorum instrumentorum usum decipere, vel ratione astri, vel medii, vel distantiæ, aut ergo*

* Plin. Nat. Hist. l. 2. c. 26.

erat in suprema parte aeris, aut si in cælo, tum forsan factum erat ex reflexione radiorum Saturni & Jovis, qui tunc in conjunctione fuerant. "Either the argument from the "paralax is not efficacious, or if it be, yet the use of the "instruments might deceive, either in regard of the star, "or the medium, or the distance, and so this comet "might be in the upper regions of the air; or if it were "in the heavens, there it might be produced by the re-"flection of the rays from Saturn and Jupiter, who were "then in conjunction." You see what shifts he is driven to, how he runs up and down to many starting holes that he may find some shelter; and instead of the strength of reason, he answers with a multitude of words, thinking (as the proverb is) that he may use hail when he hath no thunder. *Nihil turpius* (saith Seneca *) *dubio & incerto, pedem modo referente, modo producente.* "What can "there be more unseemly in one that should be a fair "disputant, than to be now here, now there, and so un-"certain, that one cannot tell where to find him?" He thinks that there are not comets in the heavens, because there may be many other reasons of such appearances; but what he knows not: perhaps (he says†) that argument from the paralax is not sufficient; or if it be, then there may be some deceit in the observation. To this I may safely say, that he may justly be accounted a weak mathematician, who mistrusts the strength of this argument; not can he know much in astronomy, who understands not the paralax, which is a foundation of that science: and I am sure that he is a timorous man, who dares not believe the frequent experience of his senses, or trust to a demonstration.

True indeed, I grant it is possible that the eye, the medium, and the distance, may all deceive the beholder; but I would have him shew which of all these was likely to cause an error in this observation? Merely to say they might be deceived, is no sufficient answer; for by this I

* Epist, 95. † Vide Galilæum Syst. Mundi, Colloq. 3.

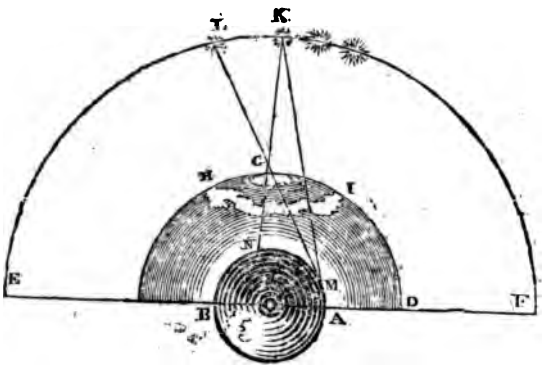
might confute the positions of all astronomers, and affirm the stars are hard by us, because it is possible they might be deceived in their observing distance. But I forbear any further reply: my opinion is of that treatise, that either it was set forth purposely to tempt a confutation, that he might see the opinion of Galilæus confirmed by others; or else it was invented with as much haste and negligence as it was printed, there being in it almost as many faults as lines.

Others think that these are not any new comets, but some ancient stars that were there before, which now shine with that unusual brightness, by reason of the interposition of such vapours, which do multiply their light; and so the alteration will be here only, and not in the heavens. Thus Aristotle thought the appearance of the milky way was produced: for he held that there were many little stars, which by their influence did constantly attract such a vapour towards that place of heaven, so that it always appeared white. Now by the same reason may a brighter vapour be the cause of these appearances.

But how probable soever this opinion may seem, yet if well considered, you shall find it to be altogether absurd and impossible: for,

1. These stars were never seen there before; and it is not likely that a vapour being hard by us, can so multiply that light which could not before be at all discerned.

2. This supposed vapour cannot be either contracted into a narrow compass, or dilated into a broad. 1. It could not be within a little space, for then that star would not appear with the same multiplied light to those in other climates. 2. It cannot be a dilated vapour, for then other stars which were discerned through the same vapour, would seem as big as that. This argument is the same in effect with that of the paralax, as you may see in this figure.



Suppose *A B* to be a hemisphere of one earth, *G D* to be the upper part of the highest region, in which there might be either a contracted vapour, as *G*, or else a dilated one, as *H I*. Suppose *E F* likewise to represent half the heavens, wherein was this appearing comet at *K*. Now I say, that a contracted vapour, as *G*, could not cause this appearance, because an inhabitant at *M* could not discern the same star with this brightness, but perhaps another at *L*, betwixt which the vapour is directly interposed. Nor could it be caused by a dilated vapour, as *H I*, because then all the stars that were discerned through it, would be perceived with the same brightness.

It is necessary therefore that the cause of this appearance should be in the heavens. And this is granted by the most and best astronomers. But, say some, this doth not argue any natural alteration in those purer bodies, since it is probable that the concourse of many little vagabond stars, by the union of their beams may cause so great a light. Of this opinion were Anaxagoras and Zeno amongst the ancient, and Baptista Cisatus, Blancanus, with others amongst our modern astronomers. For, say they, when there happens to be a concourse of some few stars, then do many other fly unto them from all the parts of heaven like so many bees unto their king. But 1. It is not likely that amongst those which we count the fixed stars, there

should be any such uncertain motions, that they can wander from all parts of the heavens, as if nature had neglected them, or forgot to appoint them a determinate course. 2. If there be such a conflux of these, as of bees to their king, then what reason is there that they do not still tarry with it, that so the comet may not be dissolved? But enough of this. You may commonly see it confuted by many other arguments. Others there are, who affirm these to be some new created stars, produced by an extraordinary supernatural power*. I answer, true indeed, it is possible they might be so, but however it is not likely they were so, since such appearances may be solved some other way; wherefore to fly unto a miracle for such things, were a great injury to nature, and to derogate from her skill; an indignity much misbecoming a man who professes himself to be a philosopher. *Miraculum* (saith one) *est ignorantiæ asylum;* a miracle often serves for the receptacle of a lazy ignorance; which any industrious spirit would be ashamed of; it being but an idle way to shift off the labour of any further search. But here is the misery of it, we first tie ourselves unto Aristotle's principles, and then conclude that nothing could contradict them but a miracle; whereas it would be much better for the commonwealth of learning, if we would ground our principles rather upon the frequent experiences of our own, than the bare authority of others.

Some there are who think that these comets are nothing else but exhalations from our earth†, carried up into the higher parts of the heaven. So Peno, Rothmannus and Galilæus. But this is not possible, since by computation it is found, that one of them is above 300 times bigger than the whole globe of land and water. Others therefore have thought that they did proceed from the body of the sun, and that that planet only is *cometarum officina, unde tanquam emissarii & exploratores emitterentur, brevi ad solem redituri*, the shop or forge of comets, from

* Clavius in sphæram, cap. 1. † Tycho Progym. l. c. 9.

whence they were sent, like so many spies, that they might in some short space return again. But this cannot be, since if so much matter had proceeded from him alone, it would have made a sensible diminution in his body. The noble Tycho therefore thinks that they consist of some such fluider parts of the heaven, as the milky way is framed of, which being condensed together, yet not attaining to the consistency of a star, is in some space of time rarified again into its wonted nature. But this is not likely, because the appearance of the milky way does not arise from some fluider parts of the heaven (as he supposes) but from the light of many lesser stars which are thereabouts*. And therefore it is usually thus described: *Via lactea nihil aliud est quam innumerabilis stellarum fixarum greges, qui confuso & pallenti lumine tractum illum inalbant.* The milky way is nothing else but the pale and confused light of many lesser stars, whereby some parts of the heaven are made to appear white.

And beside, what likely cause can we conceive of this condensation, unless there be such qualities there, as there are in our air, and then why may not the planets have the like qualities as our earth? And if so, then it is more probable that they are made by the ordinary way of nature, as they are with us, and consist of such exhalations from the bodies of the planets, as being very much rarified, may be drawn up through the orb of gross vaporous air that encompasses them. Nor is this a singular opinion; but it seemed most likely to Camillus Gloriosus, Th. Campanella, Fromondus, with some others†. But if you ask, whither shall all these exhalations return? I answer, every one into his own planet. If it be again objected, that then there will be so many centers of gravity, and each several planet will be a distinct world: I reply, we have not like probability concerning the rest; but yet perhaps all of them are so, except the sun, though Cusanus and some

* Promond. Meteor. l. 2. c. 5. art. 2. Item Vesta, tract. 5. c. 2.

† De Comet. l. 5. c. 4. Apol. pro. Galil. Meteor. l. 3. c. 2. art. 6.

others, think there is one also; and later times have discovered some lesser clouds moving round about him*. But as for Saturn, he hath two moons on each side. Jupiter hath four, that encircle him with their motion; which are likewise eclipsed by the interposition of his body, as the moon is by our earth. Venus is observed to increase and decrease as the moon. And this perhaps hath been noted by former ages, as may be guessed by that relation of St. Austin out of Varro†. Mars, and all the rest, derive their light from the sun. Concerning Mercury, there hath been little or no observation, because, for the most part, he lies hid under the sun-beams, and seldom appears by himself. But when he does, yet the compass of his body is so little, and his light of so clear a brightness, by reason of his nearness to the sun, that the perspective cannot make the same discoveries upon him, as from the rest.

So that if you consider their quantity, their opacity, or these other discoveries, you shall find it probable enough, that each of them may be a several world. Especially since every one of them is allotted to a several orb, and not altogether in one, as the fixed stars seem to be. But this would be too much for to vent at the first: the chief thing at which I now aim in this discourse, is to prove that there may be one in the moon.

It hath been before confirmed, that there was a sphere of thick vaporous air encompassing the moon, as the first and second regions do this earth. I have now shewed, that thence such exhalations may proceed as do produce the comets: now from hence it may probably follow, that there may be wind also and rain, with such other meteors as are common amongst us. This consequence is so dependant, that Fromondus dares not deny it, though he would (as he confesses himself‡;) for if the sun be able to exhale from them such fumes as may cause comets, why not then such as may cause winds, and why not such also

* Lactant. Inst. l. 3. c. 23. † De Civit. Dei, l. 21. c. 8.
‡ De Meteor. l. 3. c. 2. art. 6.

as may cause rain, since I have above shewed, that there is sea and land, as with us? Now rain seems to be more especially requisite for them, since it may allay the heat and scorchings of the sun when he is over their heads. And nature hath thus provided for those in Peru, with the other inhabitants under the line.

But if there be such great and frequent alterations in the heavens, why cannot we discern them?

I answer:

1. There may be such, and we not able to perceive them, because of the weakness of our eye, and the distance of those places from us; they are the words of Fienus (as they are quoted by Fromondus in the above-cited place) *Possunt maximæ permutationes in cælo fieri, etiamsi a nobis non conspiciantur; hoc visus nostri debilitas & immensa cæli distantia faciunt.* And unto him assents Fromondus himself, when a little after he says, *Si in sphæris planetarum degeremus, plurima forsan cælestium nebularum vellera toto æthere passim dispersa videremus, quorum species jam evanescit nimia spatii intercapedine.* "If we "did live in the spheres of the planets, we might there "perhaps discern many great clouds dispersed through "the whole heavens, which are not now visible by reason "of this great distance.

2. Mæslin and Keplar affirm, that they have seen some of these alterations. The words of Mæslin are these (as I find them cited.) *In eclipsi lunari vespere dominicæ palmarum anni* 1605, *in corpore lunæ versus boream, nigricans quædam macula conspecta fuit, obscurior cætero toto corpore, quod candentis ferri figuram repræsentabat; dixisses nubila in multam regionem extensa pluviis & tempestuosis imbribus gravida, cujusmodi ab excelsorum montium jugis in humiliora convallium loca videre non raro contingit**. "In that lunary eclipse which happened in "the even of Palm-Sunday, in the year 1605, there was a "certain blackish spot discerned in the northerly part of

* Dissert. 2. cum nunc. Galil. item Somn. Astron. nota ultima.

" the moon, being darker than any other place of her " body, and representing the colour of red hot iron; you " might conjecture that it was some dilated cloud, being " pregnant with showers; for thus do such lower clouds " appear from the tops of high mountains."

And a little before this passage, the same author speaking of that vaporous air about the moon, tells us; *Quod circumfluus ille splendor diversis temporibus apparet limpidior plus minusve.* That it does at divers times appear of a different clearness, sometimes more, and sometimes less: which he guesses to arise from the clouds and vapours that are in it.

Unto this I may add another testimony of Bapt. Cisatus, as he is quoted by Nierembergius, grounded upon an observation taken 23 years after this of Mæslin, and writ to this Euseb. Nieremberg. in a letter by that diligent and judicious astronomer. The words of it run thus; *Et quidem in eclipsi nupera solari, quæ fuit ipso die natali Christi, observavi clare in luna soli supposita, quidpiam quod valde probat id ipsum quod cometæ quoque & maculæ solares urgent, nempe cælum non esse a tenuitate & variationibus aeris exemptum; nam circa lunam adverti esse sphæram seu orbem quendam vaporosum, non secus atque circum terram, adeoque sicut ex terra in aliquam usque sphæram vapores & exhalationes expirant, ita quoque ex luna*.* " In " that late solary eclipse which happened on Christmas-" day, when the moon was just under the sun, I plainly " discerned that in her which may clearly confirm what " the comet's and sun's spots do seem to prove, viz. That " the heavens are not so solid, nor freed from those " changes which our air is liable unto; for about the " moon I perceived such an orb, or vaporous air as that is " which doth encompass our earth; and as vapours and " exhalations are raised from our earth into this air, so are " they also from the moon."

* Histor. nat. l. 2. c. 11.

You see what probable grounds, and plain testimonies I have brought for the confirmation of this proposition: many other things in this behalf might be spoken, which for brevity sake I now omit, and pass unto the next.

PROP. XIII.

That it is probable there may be inhabitants in this other world; but of what kind they are, is uncertain.

I Have already handled the seasons, and meteors belonging to this new world: it is requisite that in the next place I should come unto the third thing which I promised, and say somewhat of the inhabitants: concerning whom there might be many difficult questions raised; as, whether that place be more inconvenient for habitation than our world (as Keplar thinks); whether they are the seed of Adam; whether they are there in a blessed estate, or else what means there may be for their salvation? With many other such uncertain enquiries, which I shall willingly omit; leaving it to their examination who have more leisure and learning for the search of such particulars.

Being for mine own part content only to set down such notes belonging unto these, which I have observed in other writers. *Cum tota illa regio nobis ignota sit, remanent inhabitatores illi ignoti penitus* (saith Cusanus *;) since we know not the regions of that place, we must be altogether ignorant of the inhabitants. There hath not yet been any such discovery concerning these, upon which we may build a certainty, or good probability: well may we

* De doct. ignorantia, l. 2. c. 12.

guess at them, and that too very doubtfully, but we can know nothing; for, if we do hardly guess aright at things which be upon earth, if with labour we do find the things that are at hand, how then can we search out those things that are in heaven*? What a little is that which we know, in respect of those many matters contained within this great universe? This whole globe of earth and water, though it seem to us to be of a large extent, yet it bears not so great a proportion unto the whole frame of nature, as a small sand doth unto it; and what can such little creatures as we discern, who are tied to this point of earth? or what can they in the moon know of us? If we understand any thing (saith Esdras†) it is nothing but that which is upon the earth; and he that dwelleth above in the heavens, may only understand the things that are above in the height of the heavens.

So that it were a very needless thing for us to search after any particulars; however, we may guess in the general that there are some inhabitants in that planet: for why else did providence furnish that place with all such conveniences of habitation as have been above declared?

But you will say, perhaps, is there not too great and intolerable a heat, since the sun is in their zenith every month, and doth tarry there so long before he leaves it?

I answer, 1. This may, perhaps, be remedied (as it is under the line (by the frequency of mid-day showers, which may cloud their sun, and cool their earth.

2. The equality of their nights doth much temper the scorching of the day; and the extreme cold that comes from the one, requires some space before it can be dispelled by the other; so that the heat spending a great while before it can have the victory, hath not afterwards much time to rage in. Wherefore notwithstanding this doubt, yet that place may remain habitable. And this was the opinion of the Cardinal de Cusa, when speaking of this planet, he says, *Hic locus mundi est habitatio ho-*

* Wisd. ix. 16. † 2 Esd. iv. 21.

minum & animalium atque vegetabilium *. "This part of "the world is inhabited by men, and beast, and plants." To him assented Campanella; but he cannot determine whether they were men or rather some other kind of creatures. If they were men, then he thinks they could not be infected with Adam's sin; yet, perhaps, they had some of their own, which might make them liable to the same misery with us; out of which, it may be, they were delivered by the same means as we, the death of Christ; and thus he thinks that place of the Ephesians may be interpreted, where the Apostle says, God gathered all things together in Christ, both which are in earth, and which are in the heavens †. So also that of the same Apostle to the Colossians, where he says, that it pleased the father to reconcile all things unto himself by Christ, whether they be things in earth, or things in heaven ‡.

But I dare not jest with divine truths, or apply these places according as fancy directs. As I think this opinion doth no any where contradict scripture; so I think likewise, that it cannot be proved from it. Wherefore Campanella's second conjecture may be more probable, that the inhabitants of that world are not men as we are; but some other kind of creatures which bear some proportion and likeness to our natures. Or it may be, they are of a quite different nature from any thing here below, such as no imagination can describe; our understandings being capable only of such things as have entered by our senses, or else such mixed natures as may be composed from them. Now, there may be many other species of creatures beside those that are already known in the world; there is a great chasm betwixt the nature of men and angels: it may be the inhabitants of the planets are of a middle nature between both these. It is not improbable that God might create some of all kinds, that so he might more completely glorify himself in the works of his power and wisdom.

* De doct. ign. l. 2. cap. 12. † Ephes. i. 10. ‡ Col. i. 20.

Cusanus too, thinks they differ from us in many respects; I will set down his words as they may be found in the above-cited place, *Suspicamur in regione solis magis esse solares, claros & illuminatos intellectuales habitatores, spiritualiores etiam quam in luna, ubi magis lunatici, & in terra magis materiales & crassi, ut illi intellectualis naturæ solares sint multum in actu & parum in potentia, terreni vero magis in potentia, & parum in actu, lunares in medio fluctuantes. Hoc quidem opinamur ex influentia ignili solis, aquatica simul & aerea lunæ & gravedine materiali terræ, & consimiliter de aliis stellarum regionibus, suspicantes nullam habitationibus carere, quasi tot sint partes particulares mundiales unius universi, quot sunt stellæ quarum non est numerus, nisi apud eum qui omnia in numero creavit.*

" We may conjecture (saith he) the inhabitants of the " sun are like to the nature of that planet, more clear and " bright, more intellectual than those in the moon, where " they are nearer to the nature of that duller planet, and " those of the earth being more gross and material than " either; so that these intellectual natures in the sun, are " more form than matter, those in the earth more matter " than form, and those in the moon betwixt both. This " we may guess from the fiery influence of the sun, the " watery and aereous influence of the moon, as also the " material heaviness of the earth. In some such manner " likewise is it with the regions of the other stars; for " we conjecture that none of them are without inhabi- " tants, but that there are so many particular worlds and " parts of this one universe, as there are stars, which are " innumerable, unless it be to him who created all things " in number."

For he held that the stars were not all in one equal orb as we commonly suppose; but that some were far higher than others, which made them appear less; and that many others were so far above any of these, that they were altogether invisible unto us. An opinion which (as I con-

ceive) hath not any great probability for it, nor certainty against it.

The priest of Saturn relating to Plutarch (as he feigns it) the nature of these Selenites, told him they were of divers dispositions, some desiring to live in the lower parts of the moon, where they might look downwards upon us, while others were more surely mounted aloft, all of them shining like the rays of the sun, and as being victorious, are crowned with garlands made with the wings of Eustathia or Constancy.

It hath been the opinion amongst some of the ancients, that their heavens and Elysian fields were in the moon, where the air is most quiet and pure. Thus Socrates, thus Plato*, with his followers, did esteem this to be the place where those purer souls inhabit, who are freed from the sepulchre, and contagion of the body. And by the fable of Ceres, continually wandering in search of her daughter Proserpina, is meant nothing else but the longing desire of men, who live upon Ceres, earth, to attain a place in Proserpina, the moon or heaven.

Plutarch also seems to assent unto this; but he thinks moreover, that there are two places of happiness answerable to two parts, which he fancies to remain of a man when he is dead, the soul and the understanding; the soul he thinks is made of the moon; and as our bodies do so proceed from the dust of this earth, that they shall return to it hereafter; so our souls were generated out of that planet, and shall be resolved into it again; whereas the understanding shall ascend unto the sun, out of which it was made; where it shall possess an eternity of well-being, and far greater happiness than that which is enjoyed in the moon. So that when a man dies, if his soul be much polluted, then must it wander up and down in the middle region of the air where hell is, and there suffer unspeakable torments for those sins whereof it is guilty. Whereas the souls of better men, when they have in some space of time

* Nat. Com. l. 3. c. 19.

been purged from that impurity which they did derive from the body, then do they return into the moon, where they are possest with such joy, as those men feel who profess holy mysteries; from which place (saith he) some are sent down to have the superintendance of oracles, being diligent either in the preservation of the good, either from, or in, all perils, and the prevention or punishment of all wicked actions; but if in these employments they misbehave themselves, then are they again to be imprisoned in a body, otherwise they remain in the moon, till their souls be resolved into it, and the understanding being cleared from all impediments, ascends to the sun, which is its proper place. But this requires a diverse space of time, according to the divers affections of the soul. As for those who have been retired and honest, addicting themselves to a studious and quiet life, these are quickly preferred to a higher happiness. But as for such who have busied themselves in many broils, or have been vehement in the prosecution of any lust, as the ambitious, the amorous, the wrathful man, these still retain the glimpses and dreams of such things as they have performed in their bodies, which make them either altogether unfit to remain there, where they are, or else keeps them long ere they can put off their souls. Thus you see Plutarch's opinion concerning the inhabitants and neighbours of the moon, which (according to the manner of the Academics) he delivers in a third person; you see he makes that planet an inferior kind of heaven; and though he differs in many circumstances, yet doth he describe it to be some such place, as we suppose Paradise to be. You see likewise his opinion concerning the place of the damned spirits, that it is in the middle region of the air; and in neither of these is he singular, but some more late and orthodox writers have agreed with him. As for the place of hell, many think it may be in the air, as well as any where else.

True indeed, St. Austin affirms*, that this place cannot be discovered; but others there are who can shew the si-

* De Civit. Dei, l. 22. c. 16.

tuation of it out of scripture; some holding it to be in another world without this, because our Saviour calls it σκοτος εξωτερον *, outward darkness. But the most will have it placed towards the center of our earth, because it is said, Christ descended into the lower parts of the earth: and some of these are so confident that this is its situation, that they can describe you its bigness also, and of what capacity it is. Francis Ribera in his comment on the Revelations, speaking of those words, where it is said, that the blood went out of the wine-press, even unto the horses bridles, by the space of one thousand and six hundred furlongs †, interprets them to be meant of hell, and that that number expresses the diameter of its concavity, which is 200 Italian miles. But Lessius ‡ thinks that this opinion gives them too much room in hell, and therefore he guesses that it is not so wide; for, saith he, the diameter of one league being cubically multiplied, will make a sphere capable of 800000 millions of damned bodies, allowing to each six foot in the square; whereas, says he, it is certain, that there shall not be one hundred thousand millions in all that shall be damned. You see the bold Jesuit was careful that every one should have but room enough in hell; and by the strangeness of the conjecture, you may guess that he had rather be absurd, than seem either uncharitable or ignorant. I remember there is a relation in Pliny, how that Dionysiodorus a mathematician, being dead, did send a letter from this place to some of his friends upon earth, to certify them what distance there was betwixt the center and superficies: he might have done well to have prevented this controversy, and informed them the utmost capacity of that place. However, certain it is, that that number cannot be known; and probable it is, that the place is not yet determined, but that hell is there where there is any tormented soul, which may be in the regions of the air, as well as in the center; and

* Mat. xxv. 30. Eph. iv. 9. † Rev. xiv. 20.
‡ De morib. div. l. 13. c 24.

therefore perhaps it is, that the devil is stiled the prince of the air. But of this only occasionally, and by reason of Plutarch's opinion concerning those that are round about the moon. As for the moon itself, he esteems it to be a lower kind of heaven; and therefore in another place he calls it a terrestrial star, and an olympian or cælestial earth; answerable, as I conceive, to the paradise of the schoolmen*. And that paradise was either in, or near the moon, is the opinion of some late writers, who derived it (in all likelihood) from the assertion of Plato, and perhaps, this of Plutarch. Tostatus lays this opinion upon Isiodor. Hispalensis, and the venerable Bede, and Perius, father it upon Strabus and Rabanus his master †. Some would have it to be situated in such a place as could not be discovered; which caused the penman of Esdras to make it a harder matter to know the out-goings of paradise, than to weigh the weight of the fire, or measure the blasts of wind, or call again a day that is past ‡. But notwithstanding this, there be some others, who think that it is on the top of some high mountain under the line; and these interpreted the torrid zone to be the flaming sword whereby paradise was guarded. It is the consent of divers others, that paradise is situated in some high and eminent place. So Tostatus: *Est etiam paradisus situ altissima, supra omnem terræ altitudinem* §. "Paradise is situated in some "high place above the earth." And therefore in his comment upon the 49th of Genesis, he understands the blessing of Jacob concerning the everlasting hills, to be meant of paradise, and the blessing itself to be nothing else but a promise of Christ's coming, by whose passion the gates of paradise should be opened. Unto him assented Rupertus, Scotus, and most of the other schoolmen, as I find them cited by Pererius, and out of him in Sir Walter Rawleigh ¶. Their reason was this: because in probabi-

* Cur silent oracula. † Sir W. Raw. l. 1. c. 3. sect. 7. In Genes.
‡ 2 Esdr. iv. 7. § In Genes.
¶ Comment. in 2 Gen. v. 8. l. 1. c. 3. sect. 6, 7.

lity, this place was not overflowed by the flood, since there were no sinners there, which might draw that curse upon it. Nay, Tostatus thinks that the body of Enoch was kept there; and some of the fathers, as Tertullian and Austin have affirmed, that the blessed souls were reserved in that place till the day of judgment; and therefore it is likely that it was not overflowed by the flood. It were easy to produce the unanimous consent of the fathers, to prove that paradise is yet really existent. Any diligent peruser of them, may easily observe how they do generally interpret the paradise whereto St. Paul* was wrapt, and that wherein our Saviour promised the thief should be with him, to be locally the same from whence our first parents were banished. Now there cannot be any place on earth designed where this should be; and therefore it is not altogether improbable that it was in this other world.

And besides, since all men should have went naked if Adam had not fell, it is requisite therefore that it should be situated in some such place where it might be privileged from the extremities of heat and cold. But now this could not be (they thought) so conveniently in any lower, as it might in some higher air. For these and such like considerations, have so many affirmed that paradise was in a high elevated place: which some have conceived could be no where but in the moon: for it could not be in the top of any mountain; nor can we think of any other body separated from this earth, which can be a more convenient place for habitation than this planet; therefore they concluded that it was there.

It could not be on the top of any mountain:

1. Because we have express scripture, that the highest of them was overflowed†.

2. Because it must be of a greater extension, and not some small patch of ground, since it is likely all men should have lived there, if Adam had not fell. But for a satisfaction of the arguments, together with a farther dis-

* 2 Cor. xii. 4. Luke xxiii. 43. † Gen. vii. 19.

course of paradise, I shall refer you to those who have written purposely upon this subject. Being content for my own part to have spoken so much of it, as may conduce to shew the opinion of others concerning the inhabitants of the moon; I dare not myself affirm any thing of these Selenites, because I know not any ground whereon to build any probable opinion. But I think that future ages will discover more; and our posterity, perhaps, may invent some means for our better acquaintance with these inhabitants.

PROP. XIV.

That it is possible for some of our posterity to find out a conveyance to this other world; and if there be inhabitants there, to have commerce with them.

ALL that hath been said concerning the people of the new world, is but conjectural, and full of uncertainties; nor can we ever look for any evident or more probable discoveries in this kind, unless there be some hopes of inventing means for our conveyance thither. The possibility of which shall be the subject of our enquiry in this last proposition.

And, if we do but consider by what steps and leisure, all arts do usually rise to their growth, we shall have no cause to doubt why this also may not hereafter be found out amongst other secrets. It hath constantly yet been the method of providence, not presently to shew us all, but to lead us on by degrees, from the knowledge of one thing to another.

It was a great while ere the planets were distinguished from the fixed stars; and some time after that, ere the morning and evening star were found to be the same;

and in greater space (I doubt not) but this also, and other as excellent mysteries will be discovered. Time, who hath always been the father of new truths, and hath revealed unto us many things which our ancestors were ignorant of, will also manifest to our posterity that which we now desire, but cannot know. *Veniet tempus* (saith Seneca*) *quo ista quæ nunc latent, in lucem dies extrahet, & longioris ævi diligentia.* Time will come, when the endeavours of after-ages shall bring such things to light, as now lie hid in obscurity. Arts are not yet come to their solstice; but the industry of future times, assisted with the labours of their forefathers, may reach that height which we could not attain to. *Veniet tempus quo posteri nostri nos tam aperta nescisse mirentur.* As we now wonder at the blindness of our ancestors, who were not able to discern such things as seem plain and obvious unto us; so will our posterity admire our ignorance in as perspicuous matters.

In the first ages of the world, the inlanders thought themselves either to be the only dwellers upon earth, or else if there were any other, they could not possibly conceive how they might have any commerce with them, being severed by the deep and broad sea. But after-times found out the invention of ships; in which notwithstanding, none but some bold daring men durst venture, according to that of the tragedian:

Audax nimium qui freta primus
Rate tam fragili perfida rupit†.

Too bold was he, who in a ship so frail,
First ventured on the treacherous waves to sail.

And yet now, how easy a thing is this even to a timorous and cowardly nature? And questionless, the invention of some other means for our conveyance to the moon, cannot seem more incredible to us, than this did at first

* Nat. Qu. l. 7. c. 25. † Sen. Med. act. 1. Vide Hor. Od. 3. Juvenal. sat. 12. Claud. præf. ad. 1 lib. de rap. Proser.

to them; and therefore we have no just reason to be discouraged in our hopes of the like success.

Yea, but (you will say) there can be no sailing thither, unless that were true which the poet does but feign, that she made her bed in the sea. We have not now any Drake, or Columbus, to undertake this voyage, or any Dædalus to invent a conveyance through the air.

I answer, though we have not, yet why may not succeeding times raise up some spirits as eminent for new attempts, and strange inventions, as any that were before them? It is the opinion of Keplar*, that as soon as the art of flying is found out, some of their nation will make one of the first colonies that shall transplant into that other world. I suppose his appropriating this preheminence to his own countrymen, may arise from an over-partial affection to them. But yet thus far I agree with him, that whenever that art is invented, or any other, whereby a man may be conveyed some twenty miles high, or thereabouts, then it is not altogether improbable that some or other may be successful in this attempt.

For the better clearing of which I shall first lay down, and then answer those doubts that may make it seem utterly impossible.

These are chiefly three.

The first, taken from the natural heaviness of a man's body, whereby it is made unfit for the motion of ascent, together with the vast distance of that place from us.

2. From the extreme coldness of the æthereal air.

3. The extreme thinness of it.

Both which must needs make it impassible, though it were but as many single miles thither as it is thousands.

For the first. Though it were supposed that a man could fly, yet we may well think he would be very slow in it, since he hath so heavy a body, and such a one too, as nature did not principally intend for that kind of motion. It is usually observed, that amongst the variety of birds,

* Dissert. cum Nun. Syder.

those which do most converse upon the earth, and are swiftest in their running, as a pheasant, partridge, &c. together with all domestical fowl, are less able for flight than others which are for the most part upon the wing, as a swallow, swift, &c. And therefore we may well think, that man being not naturally endowed with any such condition as may enable him for this motion; and being necessarily tied to a more especial residence on the earth, must needs be slower than any fowl, or less able to hold out. Thus it is also in swimming; which art, though it be grown to a good eminence, yet he that is best skilled in it, is not able either for continuance, or swiftness, to equal a fish; because he is not naturally appointed to it. So that though a man could fly, yet he would be so slow in it, and so quickly weary, that he could never think to reach so great a journey as it is to the moon.

But suppose withal that he could fly as fast and long as the swiftest bird, yet it cannot possibly be conceived how he should ever be able to pass through so vast a distance as there is betwixt the moon and our earth. For this planet, according to the common grounds, is usually granted to be at the least 52 semidiameters of the earth from us; reckoning for each semidiameter 3456 English miles, of which the whole space will be about 179712.

So that though a man could constantly keep on in his journey thither by a strait line, though he could fly a thousand miles in a day, yet he would not arrive thither under 180 days, or half a year.

And how were it possible for any to tarry so long without diet or sleep?

1. For diet. I suppose there could be no trusting to that fancy of Philo the Jew (mentioned before*,) who thinks that the music of the spheres should supply the strength of food.

* Prop. 3.

Nor can we well conceive how a man should be able to carry so much luggage with him, as might serve for his *viaticum* in so tedious a journey.

2. But if he could, yet he must have some time to rest and sleep in. And I believe he shall scarce find any lodgings by the way. No inns to entertain passengers, nor any castles in the air (unless they be enchanted ones) to receive poor pilgrims, or errant knights. And so consequently he cannot have any possible hopes of reaching thither.

Notwithstanding all which doubts, I shall lay down this position.

That supposing a man could fly, or by any other means raise himself twenty miles upwards, or thereabouts, it were possible for him to come unto the moon.

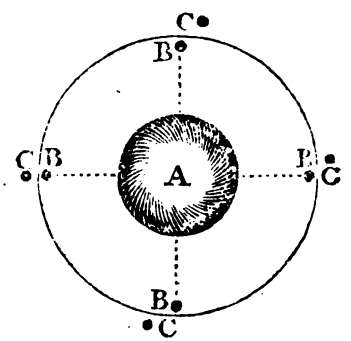
As for those arguments of the first kind, that seem to overthrow the truth of this, they proceed upon a wrong ground; whilst they suppose that a condensed body, in any place of the air, would always retain in it a strong inclination of tending downwards towards the centre of this earth. Whereas 'tis more probable, that if it were but somewhat above this orb of vaporous air, it might there rest immovable, and would not have in it any propension to this motion of descent.

For the better illustration of this, you must know, that the heaviness of a body, or (as *Aristotle* defines it *) the proneness of it to tend down unto some centre, is not any absolute quality intrinsical unto it, as if where-ever the body did retain its essence, it must also retain this quality; or as if nature had implanted in every condensed body *appetitionem centri, & fugam extremitatis*, such a love to the centre, and hatred to the extremities. Because one of these being less than a quantity, and the other no more, cannot have any power of attraction or depulsion in them. According to that common principle, *quantitatis nulla est efficacia.*

* De cælo, lib. 4. c. 1.

But now the true nature of gravity is this. 'Tis such a respective mutual desire of union, whereby condensed bodies, when they come within the sphere of their own vigour, do naturally apply themselves one to another by attraction or coition. But being both without the reach of either's virtue, they then cease to move, and though they have general aptitude, yet they have not any present inclination or proneness to one another. And so consequently cannot be styled heavy *.

The meaning of this will be more clearly illustrated by a similitude. As any light body (suppose the sun) does send forth its beams in an orbicular form; so likewise any magnetical body, for instance a round loadstone, does cast abroad his magnetical vigour in a sphere †. Thus



Where suppose the inward circle at A to represent the loadstone, and the outward one betwixt B, C, the orb that does determinate its virtue.

Now any other body that is like affected coming within this sphere, as B, will presently descend towards the centre of it, and in that respect may be styled heavy. But place it without this sphere as C, and then the desire of union ceaseth, and so consequently the motion also.

* So Keplar, Somn. Astron. N. 66. Copér. l. 1. cap. 26. Foscarin in epist. ad Sebast. Fantonum.

† Gilbert. de Magnet. l. 2. cap. 7.

To apply then what hath been said. This great globe of earth and water hath been proved by many observations, to participate of magnetical properties. And as the loadstone does cast forth its own vigour round about its body, in a magnetical compass, so likewise does our earth. The difference is, that it is another kind of affection which causes the union betwixt the iron and loadstone, from that which makes bodies move unto the earth. The former is some kind of nearness and similitude in their natures, for which philosophy, as yet, has not found a particular name. The latter does arise from that peculiar quality whereby the earth is properly distinguished from the other elements, which is its condensity. Of which the more any thing does participate, by so much the stronger will be the desire of union to it. So gold and other metals which are most close in their composition, are likewise most swift in their motion of descent.

And though this may seem to be contradicted by the instance of metals which are of the same weight, when they are melted, and when they are hard: as also of water, which does not differ in respect of gravity, when it is frozen, and when it is fluid: yet we must know that metals are not rarified by melting, but mollified. And so too for frozen waters, they are not properly condensed, but congealed into a harder substance, the parts being not contracted closer together, but still possessing the same extension. But yet (I say) 'tis very probable that there is such a sphere about the earth, which does terminate its power of attracting other things unto it. So that suppose a body to be placed within the limits of this sphere, and then it must needs tend downwards towards the centre of it. But on the contrary, if it be beyond this compass, then there can be no such mutual attraction; and so consequently it must rest immovable from any such motion.

For the farther confirmation of this, I shall propose two pertinent observations.

The first taken in the presence of many physicians, and

related by an eminent man in that profession, *Hieron. Fracastorius**. There being divers needles provided of several kinds, like those of a mariner's chart; they found that there was an attractive power not only in the magnet, but that iron also, and steel, and silver did each of them draw its own metal. Whence he concludes, *omne trahit quod sibi simile est.* And as these peculiar likenesses have such a mutual efficacy, so it is probable that this more general qualification of condensity may be the cause why things so affected desire union to the earth†. And though 'tis likely that this would appear betwixt two lesser condensed bodies, (as suppose two pieces of earth) if they were both placed at liberty in their æthereal air, yet being near the earth, the stronger species of this great globe does, as it were, drown the less.

'Tis a common experiment, that such a lump of ore or stone, as being on the ground, cannot be moved by less than six men, being in the bottom of a deep mine, may be stirred by two. The reason is, because then 'tis compassed with attractive beams, there being many above it as well as below it. Whence we may probably infer (saith the learned *Verulam*‡), "That the nature of gravity "does work but weakly also far from the earth; because "the appetite of union in dense bodies must be more dull "in respect of distance." As we may also conclude from the motion of birds, which rise from the ground but heavily, though with much labour; whereas being (high, they can keep themselves up, and soar about by the meer extension of their wings. Now the reason of this difference is not (as some falsely conceive) the depth of air under them. For a bird is not heavier when there is but a foot of air under him, than where there is a furlong. As appears by a ship in the water, (an instance of the same nature) which does not sink deeper, and so consequently is not heavier, when it has but five fathom depth, than when

* Lib. de Sympath. & Antip. c. 7.

† Vid. Bapt. Masul. exer. Acad. de attract. exer. 4.

‡ Nat. Hist. Cent. 1. exper. 33.

it has fifty. But the true reason is, the weakness of the desire of union in dense bodies at a distance.

So that from hence, there might be just occasion to tax *Aristotle* and his followers, for teaching that heaviness is an absolute quality of itself, and really distinct from condensity: whereas it is only a modification of it, or rather another name given to a condensed body in reference to its motion.

For if it were absolute, then it should always be inherent in its subject, and not have its essence depend upon the bodies being here or there. But it is not so. For,

1. Nothing is heavy in its proper place, according to his own principle, *Nihil grave est in suo loco.* And then,

2. Nothing is heavy, which is so far distant from that proper orb to which it does belong, that it is not within the reach of its virtue. As was before confirmed.

But unto this it may be objected; though a body being so placed, be not heavy *in actu secundo*; yet it is *in actu primo:* because it retains in it an inward proneness to move downwards, being once severed from its proper place. And this were reason enough why the quality of heaviness should have an absolute being.

I answer, this distinction is only applicable to such natural powers as can suspend their acts; and will not hold in elementary qualities, whose very essence does necessarily require an exercise of the second act, as you may easily discern by an induction of all the rest. I cannot say, that body has in it the quality of heat, coldness, dryness, moisture, hardness, softness, &c. which for the present has not the second act of these qualities. And if you mean by the essence of them, a power unto them: why, there is not any natural body but has a power to them all.

From that which hath been said concerning the nature of gravity, it will follow, That if a man were above the sphere of this magnetical virtue which proceeds from the earth, he might there stand as firmly in the open air, as he can now upon the ground: and not only so, but he

may also move with a far greater swiftness, than any living creatures here below; because then he is without all gravity, being not attracted any way; and so consequently will not be liable to such impediments as may in the least manner resist that kind of motion which he shall apply himself unto.

If you yet enquire, how we may conceive it possible, that a condensed body should not be heavy in such a place?

I answer, by the same reason as a body is not heavy in its proper place. Of this I will set down two instances.

1. When a man is in the bottom of a deep river, though he have over him a multitude of heavy waters, yet he is not burdened with the weight of them. And though another body, that should be but of an equal gravity with these waters, when they are taken out, would be heavy enough to press him to death; yet notwithstanding whilst they are in the channel, they do not in the least manner crush him with their load. The reason is, because they are both in their right places; and it is proper for the man, being the more condensed body, to be lower than the waters. Or rather thus, Because the body of the man does more nearly agree with the earth, in this affection, which is the ground of its attraction, and therefore doth that more strongly attract it, than the waters that are over it. Now, as in such a case, a body may lose the operation of its gravity, which is, to move, or to press downwards: so may it likewise, when it is so far out of its place, that this attractive power cannot reach unto it.

It is a pretty notion to this purpose, mentioned by Albertus de Saxonia *, and out of him by Francis Mendoca †, that the air is in some part of it navigable. And that upon this static principle, any brass or iron vessel (suppose a kettle) whose substance is much heavier than that of the water; yet being filled with the lighter air, it will swim upon it, and not sink ‡. So suppose a cup, or wooden vessel, upon

* Phys. l. 3. Q. art. 2. 6. † Viridar. l. 4. prob. 47.
‡ Vid. Arch. l. de insidentibus humido.

the outward borders of this elementary air, the cavity of it being filled with fire, or rather æthereal air, it must necessarily upon the same ground remain swimming there, and of itself can no more fall, than an empty ship can sink.

2. It is commonly granted, that if there were a hole quite through the centre of the earth, though any heavy body (as suppose a millstone) were let fall into it; yet when it came unto the place of the centre, it would there rest immoveable in the air. Now, as in this case, its own condensity cannot hinder, but that it may rest in the open air, when there is no other place to which it should be attracted; so neither could it be any impediment unto it, if it were placed without the sphere of the earth's magnetical vigor, where there should be no attraction at all.

From hence then (I say) you may conceive, that if a man were beyond this sphere, he might there stand as firmly in the open air, as now upon the earth. And if he might stand there, why might he not also go there? And if so; then there is a possibility likewise of having other conveniences for travelling.

And here it is considerable, that since our bodies will then be devoid of gravity, and other impediments of motion; we shall not at all spend ourselves in any labour, and so consequently not much need the reparation of diet: but may perhaps live altogether without it, as those creatures have done, who by reason of their sleeping for many days together, have not spent any spirits, and so not wanted any food: which is commonly related of serpents, crocodiles, bears, cuckoos, swallows, and such like. To this purpose, Mendoca * reckons up divers strange relations. As that of Epimenides, who is storied to have slept 75 years. And another of a rustic in Germany, who being accidentally covered with a hay-rick slept there for all autumn, and the winter following, without any nourishment.

Or, if this will not serve; yet why may not a papist fast

* Viridar. l. 4. prob. 24.

so long, as well as Ignatius or Xaverius? Or if there be such a strange efficacy in the bread of the eucharist, as their miraculous relations do attribute to it: why then, that may serve well enough, for their *viaticum*.

Or, if we must needs feed upon something else, why may not smells nourish us? Plutarch * and Pliny † and divers other ancients, tell us of a nation in *India* that lived only upon pleasing odours. And it is the common opinion of physicians, that these do strangely both strengthen and repair the spirits. Hence was it that Democritus was able, for divers days together, to feed himself with the meer smell of hot bread ‡.

Or if it be necessary that our stomachs must receive the food: why then it is not impossible that the purity of the æthereal air, being not mixed with any improper vapours, may be so agreeable to our bodies, as to yield us sufficient nourishment; according to that of the Poet §:

——Vescitur aurâ
Æthereâ——

It was an old Platonic principle, that there is in some part of the world such a place where men might be plentifully nourished by the air they breathe: which cannot more properly be assigned to any one particular, than to the æthereal air above this.

I know it is the common opinion, that no element can prove aliment, because it is not proportionate to the bodies of living creatures which are compounded ‖. But,

1. The æthereal air is not an element; and though it be purer, yet it is perhaps of a greater agreeableness to man's nature and constitution.

2. If we consult experience and the credible relations of others, we shall find it probable enough that many things receive nourishment from meet elements.

First, for the earth; Aristotle ** and Pliny ††, those two

* De facie in Luna. † Nat. Hist. l. 7. c. 2. ‡ Diog. Laer. l. 1. c. 9.
§ Virgil. ‖ Arist. de Sens. c. 5. ** Hist. Animal. l. 8. c. 5.
†† Hist. l. 10. c. 72.

great naturalists, tell us of some creatures, that are fed only with this. And it was the curse of the serpent, Gen. iii. 14. Upon thy belly shalt thou go, and dust shalt thou eat all the days of thy life.

So likewise for the water. Albertus Magnus * speaks of a man who lived seven weeks together by the meer drinking of water. Rondoletius † (to whose diligence these later times are much beholden for sundry observations concerning the nature of aquatils;) affirms that his wife did keep a fish in a glass of water, without any other food, for three years; in which space it was constantly augmented, till at first it could not come out of the place at which it was put in, and at length was too big for the glass itself, though that were of a large capacity. Cardan tells us of some worms, that are bred and nourished by the snow, from which being once separated, they die ‡.

Thus also is it with the air, which we may well conceive does chiefly concur to the nourishing of all vegetables. For if their food were all sucked out from the earth, there must needs be then some sensible decay in the ground by them; especially since they do every year renew their leaves and fruits: which being so many, and so often, could not be produced without abundance of nourishment. To this purpose is the experiment of trees cut down which will of themselves put forth sprouts. As also that of onions, and the semper-vive, which will strangely shoot forth, and grow as they hang in the open air. Thus likewise is it with some sensible creatures; the camelion (saith Pliny‖ and Solinus §) meerly nourished by this: and so are the birds of paradise, treated of by many, which reside constantly in the air, nature having not bestowed upon them any legs, and therefore they are never seen upon the ground but being dead ¶. If you ask how they multiply? It is answered, they

* De Animal. l. 7. † De Pisc. l. 1. c. 12. ‡ Subtil. l. 9.

‖ Hist. l. 8. cap. 33. Polyhistor. cap. 53.

§ Lop. hist. Ind. Occid. cap. 96. Maiolus, Colloq. 3.

¶ Tis likely that these birds do chiefly reside in the æthereal air, where they are nourished and upheld.

lay their eggs on the backs of one another, upon which they sit till their young ones be fledged. Rhondoletius*, from the history of Hermolaus Barbarus, tells us of a priest (of whom one of the popes had the custody) that lived forty years upon meer air. As also of a maid in France, and another in Germany, that for divers years together did feed on nothing but this: nay, he affirms that he himself had seen one, who lived till ten years of age without any other nourishment. You may find most of these, and some other examples to this purpose, gathered together by Mendoca, Viridar. lib. 4. prob. 23, 24. Now, if this elementary air, which is mixed with such improper vapours, may accidentally nourish some persons; perhaps then, that pure æthereal air may of itself be more natural to our tempers.

But if none of these conjectures may satisfy; yet there may haply be some possible means for the conveyance of other food, as shall be shewed afterwards.

Again, seeing we do not then spend ourselves in any labour, we shall not, it may be, need the refreshment of sleep. But if we do, we cannot desire a softer bed than the air, where we may repose ourselves firmly and safely as in our chambers.

But here you may ask, whether there be any means for us to know, how far this sphere of the earth's virtue does extend itself?

I answer, 'tis probable that it does not reach much farther than that orb of thick vaporous air, that encompasseth the earth; because 'tis likely the sun may exhale some earthly vapours, near unto the utmost bounds of the sphere allotted to them.

Now there are divers ways used by astronomers, to take the altitude of this vaporous air. As,

1. By observing the height of that air which causeth the crepusculum, or twilight; for the finding of which, the ancients used this means: as soon as ever they could discern the air in the east to be altered with the least light, they

* De Piscibus, l. 1. cap. 13.

would by the situation of the stars find out how many degrees the sun was below the horizon, which was usually about eighteen. From whence they would easily conclude, how high that air must be above us, which the sun could shine upon, when he was 18 degrees below us. And from this observation, it was concluded to be about 52 miles high*.

But in this conclusion, the ancients were much deceived, because they proceeded upon a wrong ground, whilst they supposed that the shining of the sun's direct rays upon the air, was the only reason of the crepusculum; whereas it is certain that there are many other things which may also concur to the causing of it†. As,

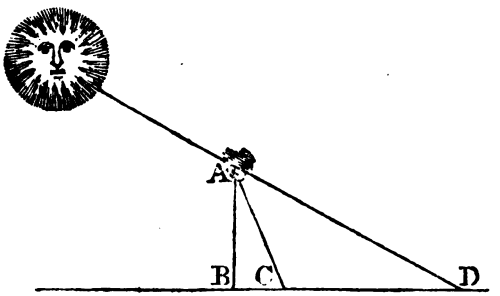
1. Some bright clouds below the horizon, which being illuminated by the sun, may be the means of conveying some light to our air, before the direct rays can touch it.

2. The often refraction of the rays, which suffer a frequent repercussion from the cavity of this sphere, may likewise yield us some light.

3. And so may the orb of enlightened air compassing the sun, part of which must rise before his body.

2. The second way whereby we may more surely find the altitude of this grosser air, is by taking the heighth of the highest cloud: which may be done, 1. Either as they use to measure the altitude of things that cannot be approached unto, viz. by two stations, when two persons shall at the same time, in several places, observe the declination of any cloud from the vertical point. Or, 2. which is the more easy way, when a man shall chuse such a station, where he may at some distance discern the place on which the cloud does cast its shadow, and withal does observe, how much both the cloud and the sun decline from the vertical point‡. From which he may easily conclude the true altitude of it, as you may more plainly conceive by this following diagram.

* Vitel. l. 10. Theo. 7. † Keplar Ep. Coper. l. 1. part 3.
‡ Stevinius, Geog. l. 3. prop. 3.



Where A B is a perpendicular from the cloud, C the station of him that measures, D the place where the shadow of the cloud does fall.

The instrument being directed from the station C, to the cloud at A, the perpendicular will shew the angle B A C. Then letting the sun shine through the sights of your instrument, the perpendicular of it will give the angle B A D. Afterwards having measured the distance C D by paces, you may according to the common rules, find the heighth B A*.

But if without making the observation, you would know of what altitude the highest of these are found by observation; Cardan† answers, not above two miles; Keplar‡ not above 16000 paces or thereabouts.

3. Another way to find the height of this vaporous air, is, by knowing the difference of altitude which it causeth in refracting the beams of any star near the horizon. And from this observation also, it is usually concluded to be about two or three miles high.

But now you must not conceive, as if the orb of magnetical vigour were bounded in an exact superficies, or as if it did equally hold out just to such a determinate line, and no farther. But, as it hath been said of the first region, which is there terminated where the heat of reflexion does begin to languish; so likewise is it probable, that this magnetical vigour does remit of its degrees proportionally to its distance from the earth, which is the cause of it: and therefore

* Pitisc. Trigon. † Subt. l. 17. ‡ Epit. Cop. l. 1. p. 3.

though the thicker clouds may be elevated no higher, yet this orb may be continued in weaker degrees a little beyond them. We will suppose it (which in all likelihood is the most) to be about twenty miles high. So that you see the former thesis remains probable; that if a man could but fly, or by any other means get twenty miles upwards, it were possible for him to reach unto the moon.

But it may be again objected; though all this were true; though there were such an orb of air which did terminate the earth's vigor: and though the heaviness of our bodies could not hinder our passage through the vast spaces of the æthereal air; yet those two other impediments may seem to deny the possibility of any such voyage.

1. The extreme coldness of that air. If some of our higher mountains for this reason be not habitable, much more then will those places be so, which are farther from any cause of heat.

2. The extreme thinness of it, which may make it unfit for expiration. For, if in some mountains (as Aristotle tells us of Olympus, and out of him St. Austin*) the air be so thin, that men cannot draw their breath, unless it were through some moistened spunges; much more then must that air be thin, which is more remotely situated from the causes of impurity and mixture. And then beside, the refraction that is made by the vaporous air encompassing our earth, may sufficiently prove that there is a great difference betwixt the æthereal air and this, in respect of rarity.

To the first of these I answer, that though the second region be naturally endowed with so much coldness, as may make it fit for the production of meteors; yet it will not hence follow, that all that air above it, which is not appointed for the like purpose, should partake of the same condition: but it may seem more probable, that this æthereal air is freed from having any quality in the extremes. And this may be confirmed from those common arguments,

* In Gen. ad literam, l. 3. cap. 2.

which are usually brought to prove the warmness of the third region; as you may see in Fromundus*, and others who treat of that subject.

'Tis the assertion of Pererius†, that the second region is not cold merely for this reason, because it is distant from the ordinary causes of heat, but because it was actually made so at the first, for the condensing of the clouds, and the production of other meteors that were there to be generated; which (as I conceive) might be sufficiently confirmed from that order of the creation observed by Moses, who tells us that the waters above the firmament (by which, in the greatest probability, we are to understand the clouds in the second region) were made the second day, Gen. i. 7, 8. whereas the sun itself (whose reflection is the cause of heat) was not created till the fourth day, ver. 16, 19.

To the other objection I answer, that though the air in the second region (where by reason of its coldness there are many thick vapours) do cause a great refraction; yet it is probable that the air which is next the earth, is sometimes, and in some places, of a far greater thinness; nay, as thin as the æthereal air itself; since sometimes there is such a special heat of the sun, as may rarify it in an eminent degree: and in some dry places, there are no gross impure exhalations to mix with it.

But here it may be objected: if the air in the second region were more condensed and heavy than this wherein we breath, then that must necessarily tend downwards, and possess the lower place.

To this some answer, that the hanging of the clouds in the open air, is no less than a miracle. They are the words of Pliny‡: *quid mirabilius aquis in cælo stantibus?* what more wonderful thing is there, than that the waters should stand in the heavens? Others prove this from the derivation of the word שמים from שאה *stupescere* and מים *aquæ*; because the waters do hang there after such a stupendous in-

* Meteor. lib. 1. ca. 2. art. 1.
† Comment. in Gen. i. 8.
‡ Hist. l. 3. cap. 1.

conceivable manner: which seems likewise to be favoured by scripture, where it is mentioned as a great argument of God's omnipotency, that he holds up the clouds from falling. He binds up the waters in his thick clouds, and the cloud is not rent under them*.

But that which unto me seems full satisfaction against this doubt, is this consideration; that the natural vigour whereby the earth does attract dense bodies unto it, is less efficacious at a distance; and therefore a body of less density, which is near unto it, as suppose this thin air wherein we breathe, may naturally be lower in its situation, than another of a greater condensity that is farther off; as suppose the clouds in the second region. And though the one be absolutely, and in itself more fit for this motion of descent; yet by reason of its distance, the earth's magnetical virtue cannot so powerfully work upon it.

As for that relation of Aristotle, if it were true, yet it does not prove this air to be altogether impassible, since moistened sponges might help us against its thinness: but it is more likely that he took it upon trust, as he did some other relations concerning the height of the mountains, wherein it is evident that he was grosly mistaken: as where he tells us of Caucasus, that it casts its shadow 560 miles†. And this relation being of the same nature, we cannot safely trust unto him for the truth of it.

If it be here enquired, what means there may be conjectured, for our ascending beyond the sphere of the earth's magnetical vigour.

I answer. 1. It is not perhaps impossible that a man may be able to fly by the application of wings to his own body: as angels are pictured, as Mercury and Dædalus are feigned, and as hath been attempted by divers; particularly by a Turk in Constantinople, as Busbequius relates.

2. If there be such a great ruck in Madagascar, as Marcus Polus‡ the Venetian mentions, the feathers in whose wings

* Job xxvi. 8. † Meteor. l. 1. c. 11. ‡ Lib. 3. c. 40.

are twelve foot long, which can soop up a horse and his rider, or an elephant, as our kites do a mouse; why then it is but teaching one of these to carry a man, and he may ride up thither, as Ganymede does, upon an eagle.

3. Or if neither of these ways will serve: yet I do seriously, and upon good grounds affirm it possible to make a flying-chariot; in which a man may sit, and give such a motion unto it, as shall convey him through the air. And this perhaps might be made large enough to carry divers men at the same time, together with food for their *viaticum*, and commodities for traffic. It is not the bigness of any thing in this kind, that can hinder its motion, if the motive faculty be answerable thereunto. We see a great ship swims as well as a small cork, and an eagle flies in the air as well as a little gnat.

This engine may be contrived from the same principles by which Archytas made a wooden dové, and Regiomontanus a wooden eagle.

I conceive it were no difficult matter (if a man had leisure) to shew more particularly the means of composing it.

The perfecting of such an invention, would be of such excellent use, that it were enough, not only to make a man famous, but the age also wherein he lives. For besides the strange discoveries that it might occasion in this other world, it would be also of inconceivable advantage for travelling, above any other conveyance that is now in use.

So that notwithstanding all these seeming impossibilities, it is likely enough, that there may be a means invented of journeying to the moon; and how happy shall they be, that are first successful in this attempt?

> ——— *Felicesque animæ, quas nubila supra,*
> *Et turpes fumos, plenumque vaporibus orbem,*
> *Inseruit cælo sancti scintilla Promethei.*

Having thus finished this discourse, I chanced upon a late fancy to this purpose, under the feigned name of Domingo Gonsales, written by a late reverend and learned

bishop: in which (besides sundry particulars wherein this latter chapter did unwittingly agree with it) there is delivered a very pleasant and well-contrived fancy concerning a voyage to this other world.

He supposeth that there is a natural and usual passage for many creatures betwixt our earth and this planet. Thus he says, those great multitudes of locusts, wherewith divers countries have been destroyed, do proceed from thence. And if we peruse the authors who treat of them, we shall find that many times they fly in numberless troops, or swarms, and for sundry days together before they fall, are seen over those places in great high clouds, such as coming nearer, are of extension enough to obscure the day, and hinder the light of the sun. From which, together with divers other such relations, he concludes that it is not altogether improbable they should proceed from the moon. Thus likewise he supposeth the swallows, cuckoos, nightingales, with divers other fowl, which are with us only half the year, to fly up thither, when they go from us. Amongst which kind, there is a wild swan in the East Indies, which at certain seasons of the year do constantly take their flight thither. Now this bird being of great strength, able to continue for a long flight, as also going usually in flocks, like our wild-geese; he supposeth that many of them together, might be taught to carry the weight of a man; especially if an engine were so contrived (as he thinks it might) that each of them should bear an equal share in the burthen. So that by this means it is easily conceivable, how once every year a man might finish such a voyage; going along with these birds at the beginning of winter, and again returning with them at the spring.

And here, one that had a strong fancy, were better able to set forth the great benefit and pleasure to be had by such a journey. And that whether you consider the strangeness of the persons, language, arts, policy, religion of those inhabitants, together with the new traffic that might be brought thence. In brief, do but consider the pleasure and

profit of those later discoveries in America, and we must needs conclude this to be inconceivably beyond it.

But such imaginations as these, I shall leave to the fancy of the reader.

——————— *Sic itur ad astra.*
Reptet humi quicunque velit ———

Cælo restat iter, cælo tentabimus ire.

BOOK II.

A DISCOURSE

CONCERNING A

NEW PLANET,

TENDING TO PROVE, THAT (IT IS PROBABLE)

OUR EARTH IS ONE OF THE PLANETS.

Digna res est contemplatione, ut sciamus in quo rerum statu scimus: pigerrimam sortiti, an velocissimam sedem: circa nos deus omnia, an nos agat.

Sen. Nat. Quæst. lib. 7. cap. 2.

TO THE READER.

NOT to trouble you with an invective against those multitudes of pamphlets which are every day pressed into the world; or an apology, why this was published amongst the rest (the usual matter for such kind of epistles:) let me in brief premonish you something concerning the

CHIEF SCOPE and MANNER } *of this following Discourse.*

1. *It is not the purpose of it to set down an exact treatise of this kind of astronomy, but rather to remove those common prejudices which usually deter men from taking any argument, tending this way, into their considerations. For we may observe, that in those points which are cried down by the more general opinion, men do for the most part rest themselves in the superficial knowledge of things, as they seem at their first appearances, thinking they can say enough to any paradox, against which they can urge the most obvious and easy objections; and therefore seldom or never search into the depth of these points, or enter into any serious impartial examination of those grounds on which they are bottomed. Which as it must needs be a great hindrance to the proficiency of all kind of learning, so more especially is it in this particular. We might discern a greater comeliness and order in this great fabrick of the world, and more easily understand the appearances in astronomy, if we could with indifferency attend to what might be said for that opinion of Copernicus, which is here defended.*

2. *For the manner. It is not maintained with such heat and religion, as if every one that reads it were presently bound to yield up his assent: but as it is in other wars where victory cannot be had, men must be content with peace: so likewise is it in this, and should be in all other philosophical*

contentions. If there be nothing able to convince and satisfy the indifferent reader, he may still enjoy his own opinion. All men have not the same way of apprehending things; but according to the variety of their temper, custom, and abilities, their understandings are severally fashioned to different assents: which had it been but well considered by some of our hot adversaries, they would not have shewed more violence in opposing the persons against whom they write, than strength in confuting the cause.*

It is an excellent rule to be observed in all disputes, that men should give soft words and hard arguments; that they would not so much strive to vex, as to convince an enemy. If this were but diligently practised in all cases, and on all sides, we might in a good measure be freed from those vexations in the search of truth, which the wise Solomon, by his own experience did so much complain of, Ecclesiastes i. 18. *In much wisdom there is much grief; and he that increaseth knowledge, increaseth sorrow.*

To conclude: though there should be nothing in this discourse conducible to your information and benefit; yet it may serve in the perusal, as it did in the composure, for the recreation of such leisure hours as may conveniently be spared from more weighty employments.

Farewell.

* Fromond. Al. Ross.

BOOK II.

THAT THE EARTH MAY BE A PLANET.

PROP. I

That the seeming novelty and singularity of this opinion, can be no sufficient reason to prove it erroneous.

IN the search of theological truths, it is the safest method, first of all to look unto divine authority; because that carries with it as clear an evidence to our faith, as any thing else can be to our reason. But on the contrary, in the examination of philosophical points, it were a preposterous course to begin at the testimony and opinion of others, and then afterwards to descend unto the reasons that may be drawn from the nature and essence of the things themselves: because these inartificial arguments (as the logicians call them) do not carry with them any clear and convincing evidence; and therefore should come after those that are of more necessary dependance, as serving rather to confirm, than resolve the judgment.

But yet, so it is, that in those points which are besides the common opinion, men are carried away at the first by the general cry, and seldom or never come so far, as to examine the reasons that may be urged for them. And therefore, since it is the purpose of this discourse, to remove those prejudices which may hinder our judgment in the like case, it is requisite that in the first place there be some satisfaction given to those arguments that may be taken from the authority of others.

Which arguments are insisted on by our adversaries with much heat and violence.

What (say they) shall an upstart novelty thrust out such a truth as hath passed by successive tradition through all ages of the world; and hath been generally entertained, not only in the opinion of the vulgar, but also of the greatest philosophers, and most learned men *? Shall we think that amongst the multitude of those who in several times have been eminent for new inventions, and strange discoveries, there was none able to find out such a secret as this, besides some fabulous Pythagoreans, and of late Copernicus? Is it probable that the world should last for above five thousand years together, and yet the inhabitants of it be so dull and stupid, as to be unacquainted with its motion? Nay, shall we think that those excellent men whom the Holy Ghost made use of in the penning of scripture, who were extraordinarily inspired with supernatural truths, should notwithstanding be so grossly ignorant of so common a matter as this? Can we believe, if there were any such thing, that Joshua, and Job, and David, and Solomon, &c. should know nothing of it? Certainly it must needs argue a strong affectation of singularity, for a man to take up any groundless fancy against such ancient and general authority.

I answer: as we should not be so fondly conceited of ourselves, and the extraordinary abilities of these present ages, as to think every thing that is ancient to be obsolete: or, as if it must needs be with opinions as it is with clothes, where the newest is for the most part best. So neither should we be so superstitiously devoted to antiquity, as to take up every thing for canonical, which drops from the pen of a father, or was approved by the consent of the ancients. It is an excellent saying, Δει ελευθεριον ειναι τη γνωμη του μελλοντα φιλοσοφειν. It behoves every one in the search of truth, always to preserve a philosophical liberty; not to be so enslaved to the opinion of any man, as to think whatever he says to be infallible. We must

* Alex. Ross de terræ motu, contra Lansb. l. 1. sect. 1. cap. 10.
† Alcinous.

labour to find out what things are in themselves, by our own experience, and a thorough examination of their natures, not what another says of them. And if in such an impartial enquiry, we chance to light upon a new way, and that which is besides the common road, this is neither our fault, nor our unhappiness.

Not our fault, because it did not arise from singularity or affectation. Not our unhappiness, because it is rather a privilege to be the first in finding out such truths as are not discernible to every common eye. If novelty should always be rejected, neither would arts have arrived to that perfection wherein now we enjoy them, nor could we ever hope for any future reformation: though all truth be in itself eternal, yet in respect of men's opinions, there is scarce any so ancient but had a beginning, and was once counted a novelty; and if for this reason it had been condemned as an error, what a general darkness and ignorance would then have been in the world, in comparison of that light which now abounds; according to that of the poet:

Quod si tam antiquis novitas invisa fuisset,
Quam nobis, quid nunc esse vetus aut quid haberet,
Quod legeret tereretque viritim publicus usus ?*

If our forefathers had but hated thus,
All that were new; what had been old to us?
Or, how might any thing confirmed be,
For public use by its antiquity?

But for more full satisfaction of all those scruples that may arise from the seeming novelty or singularity of this opinion, I shall propose these following considerations.

1. Suppose it were a novelty, yet it is in philosophy, and that is made up of nothing else; but receives addition from every day's experiment. True indeed, for divinity we have an infallible rule that does plainly inform us of all necessary truths; and therefore the primitive times are of greater

* Horat. lib. 2. ep. 1.

authority, because they were nearer to those holy men who were the penmen of scripture. But now for philosophy, there is no such reason: whatever the schoolmen may talk, yet Aristotle's works are not necessarily true, and he himself hath by sufficient arguments proved himself to be liable unto error. Now in this case, if we should speak properly, antiquity does consist in the old age of the world, not in the youth of it. In such learning as may be increased by fresh experiments and new discoveries; it is we are the fathers, and of more authority than former ages; because we have the advantage of more time than they had, and truth (we say) is the daughter of time. However, there is nothing in this opinion so magisterially proposed, but the reader may use his own liberty; and if all the reasons considered together do not seem convincing unto him, he may freely reject it.

In those natural points which carry with them any doubt or obscurity, it is the safest way to suspend our assents; and though we may dispute *pro* or *con*, yet not to settle our opinion on either side.

2. In weighing the authority of others, it is not their multitude that should prevail, or their skill in some things that should make them of credit in every thing; but we should examine what particular insight and experience they had in those things for which they are cited. Now it is plain, that common people judge by their senses, and therefore their voices are altogether unfit to decide any philosophical doubt, which cannot well be examined or explained without discourse and reason. And as for the ancient fathers, though they were men very eminent for their holy lives, and extraordinary skill in divinity, yet they were most of them very ignorant in that part of learning which concerns this opinion; as appears by many of their gross mistakes in this kind; as that concerning the antipodes, &c. and therefore it is not their opinion neither, in this business, that to an indifferent seeker of truth will be of any strong authority.

But against this it is objected*. That the instance of the antipodes does not argue any special ignorance in these learned men; or that they had less skill in such human arts than others; since Aristotle himself, and Pliny, did deny this as well as they.

I answer:

1. If they did, yet this does make more to the present purpose: for if such great scholars, who were so eminent for their knowledge in natural things, might yet notwithstanding be grossly mistaken in such matters as are now evident and certain, why then we have no reason to depend upon their assertions or authorities, as if they were infallible.

2. Though these great naturalists, for want of some experience, were mistaken in that opinion, whilst they thought no place was habitable but the temperate zones: yet it cannot be from hence inferred that they denied the possibility of antipodes; since these are such inhabitants as live opposite unto us in the other temperate zone: and it were an absurd thing to imagine that those who lived in different zones, can be antipodes to one another; and argues that a man did not understand, or else had forgotten that common distinction in geography, wherein the relation of the world's inhabitants unto one another are reckoned up under these three heads; *antaci*, *periæci*, and *antipodes*. But to let this pass: it is certain, that some of the fathers did deny the being of any such, upon other more absurd grounds. Now if such as Chrysostom, Lactantius, &c. who were noted for great scholars; and such too as flourished in these latter times, when all human learning was more generally professed, should notwithstanding be so much mistaken in so obvious a matter: why then may we not think that those primitive saints, who were the penmen of scripture, and eminent above others in their time for holiness and knowledge; might yet be utterly ignorant of many philosophical truths, which are commonly known in these

* Alex. Ross. l. 1. sect. c. 8.

days? It is probable, that the Holy Ghost did inform them only with the knowledge of those things whereof they were to be the penmen, and that they were not better skilled in points of philosophy than others. There were indeed some of them who were supernaturally endowed with human learning; yet this was, because they might thereby be fitted for some particular ends, which all the rest were not appointed unto: thus Solomon was strangely gifted with all kind of knowledge, in a great measure; because he was to teach us by his own experience the extreme vanity of it, that we might not so settle our desires upon it, as if it were able to yield us contentment*. So too the apostles were extraordinarily inspired with the knowledge of languages, because they were to preach unto all nations. But it will not hence follow, that therefore the other holy penmen were greater scholars than others. It is likely that Job had as much human learning as most of them, because his book is more especially remarkable for lofty expressions, and discourses of nature; and yet it is not likely that he was acquainted with all those mysteries which later ages have discovered; because when God would convince him of his own folly and ignorance, he proposes to him such questions, as being altogether unanswerable; which notwithstanding, any ordinary philosopher in these days might have resolved. As you may see at large in the thirty-eighth chapter of that book.

The occasion was this: Job† having before desired that he might dispute with the Almighty concerning the uprightness of his own ways, and the unreasonableness of those afflictions which he underwent, does at length obtain his desire in this kind; and God vouchsafes, in this thirty-eighth chapter, to argue the case with him. Where he does shew Job how unfit he was to judge of the ways of providence, in disposing of blessings and afflictions; when as he was so ignorant in ordinary matters, being not able to discern the reason of natural and common events. As why

* Eccl. i. 18. † Cap. xiii. 3.

the sea should be so bounded from overflowing the land*? What is the breadth of the earth†? What is the reason of the snow or hail‡? What was the cause of the rain or dew, of ice and frost, and the like‖? By which questions, it seems, Job was so utterly puzzled, that he is fain afterwards to humble himself in this acknowledgment: I have uttered that I understood not, things too wonderful for me, which I knew not. Wherefore I abhor myself, and repent in dust and ashes§.

So that it is likely these holy men had not these human arts by any special inspiration, but by instruction and study, and other ordinary means; and therefore Moses his skill in this kind is called the learning of the Egyptians¶. Now, because in those times all sciences were taught only in a rude and imperfect manner; therefore it is likely that they also had but a dark and confused apprehension of things, and were liable to the common errors. And for this reason is it, why Tostatus** (speaking of Joshua's bidding the moon stand still as well as the sun) says, *Quod forte erat imperitus circa astrorum doctrinam, sentiens ut vulgares sentiunt:* that perhaps he was unskilful in astronomy, having the same gross conceit of the heavens, as the vulgar had. From all which it may be inferred, that the ignorance of such good men and great scholars concerning these philosophical points, can be no sufficient reason, why after examination we should deny them, or doubt of their truth.

3. It is considerable, that in the rudiments and first beginnings of astronomy, and so in several ages after, this opinion hath found many patrons, and those too men of eminent note and learning. Such was more especially Pythagoras, who was generally and highly esteemed for his divine wit, and rare inventions; under whose mysterious sayings, there be many excellent truths to be discovered.

But against his testimony, it is again objected††; if Pytha-

* Ver. 8, 10, 11. † Ver. 18. ‡ Ver. 22. ‖ Ver. 28, 29.
§ Cap. xlii. ver. 3, 6. ¶ Acts vii. 22.
** Josh. c. 10. Quæst. 19. †† Alex. Ros. l. 2. sect. 2. c. 10.

goras were of this opinion, yet his authority should not be of any credit, because he was the author of many other monstrous absurdities.

To this I answer; if a man's error in some particulars should take away his credit for every thing else, this would abolish the force of all human authority; for *humanum est errare*. Secondly, it is probable that many of Pythagoras's sayings which seem so absurd, are not to be understood according to their letter, but in a mystical sense.

2. But he objects again, that Pythagoras was not of this opinion; and that for two reasons; first, because no ancient author that he had read ascribes it unto him. Secondly, it is contradictory to his other opinions, concerning the harmony that was made by the motion of the heavens; which could not consist with this other of the earth's motion.

To the first I answer; the objector could not chuse but know that this assertion is by many ancient authors ascribed to that sect whereof Pythagoras was the chief. He might have seen it expressly in Aristotle* himself. Οι δε Πυθαγορειοι λεγουσιν επι μεν του μεσω πυρ ειναι, την τε γην εν των αστρων ουσαν κυηλῳ φερομενην περι μεσιν, νυκτα τε και ἡμεραν ποιειν.

In which the philosopher does compendiously reckon up the three chief particulars implied in the opinion of the Pythagoreans. First, the sun's being in the centre of the world. Secondly, the earth's annual motion about it, as being one of the planets. Thirdly, its diurnal revolution, whereby it caused day and night.

To his second reason I answer; first, that Pythagoras thought the earth to be one of the planets (as appears by Aristotle's testimony concerning him) and to move amongst the rest. So that his opinion concerning the motion of the heavens is not inconsistent with that of the earth. Secondly, but as for the celestial harmony, he might perhaps under this mystical expression, according to his usual custom, shadow forth unto us that mutual proportion and harmonical consent, which he did conceive in the several big-

* De Cælo, l. 2. c. 13.

ness, distance, motions of the orbs. So that notwithstanding these objections, it is evident that Pythagoras was of this opinion, and that his authority may add somewhat for the confirmation of it. Unto him assented Aristarchus Samius*, who flourished about 280 years before the birth of our Saviour; and was by reason of this opinion, arraigned for profaneness and sacrilege by the Areopagites; because he had blasphemed the deity of Vesta, affirming the earth to move. To them agreed Philolaus, Heraclides, Pontius, Nicetas, Syracusanus, Ecphantus, Lucippus, and Plato himself (as some think.) So likewise Numa Pompilius, as Plutarch relates it in his life; who in reference to this opinion, built the temple of Vesta round, like the universe; in the middle of it was placed the perpetual vestal fire; by which he did represent the sun in the centre of the world. All these men were in their several times of special note, as well for their extraordinary learning, as for this opinion.

4. It is considerable, that since this science of astronomy hath been raised to any perfection, there have been many of the best skill in it, that have assented unto that assertion which is here defended. Amongst whom was the cardinal Cusanus†, but more especially Copernicus, who was a man very exact and diligent in these studies for above thirty years together, from the year 1500 to 1530, and upwards; and since him, most of the best astronomers have been of this side. So that now there is scarce any of note and skill, who are not Copernicus's followers; and if we should go to most voices, this opinion would carry it from any other. It would be too tedious to reckon up the names of those that may be cited for it; I will only mention some of the chief; such were Joachinus Rheticus, an elegant writer; Christopherus Rothman; Mestlin, a man very eminent for his singular skill in this science; who though at the first he were a follower of Ptolemy, yet upon his second and more exact thoughts, he concluded Copernicus to be in the right; and that the usual hypothesis, *præscriptione potius quam*

* Archimedes de arænæ numero. † De doct. ignor. l. 2. cap. 12.

*ratione valet**, does prevail more by prescription than reason. So likewise Erasmus Reinoldus, who was the man that calculated the prutenical tables from Copernicus his Observations, and did intend to write a commentary upon his other works, but that he was taken out of this life before he could finish those resolutions. Unto these also I might add the names of Gilbert, Keplar, Galilæus, with sundry others, who have much beautified and confirmed this hypothesis, with their new inventions†. Nay I may safely affirm, that amongst the variety of those opinions that are in astronomy, there are more (of those which have skill in it) that are of this opinion, not only than any other side, but than all the rest put together. So that now it is a greater argument of singularity to oppose it.

5. It is probable, that many other of the ancients would have assented unto this opinion, if they had been acquainted with those experiments which later times have found out for the confirmation of it: and therefore Rheticus‡ and Keplar‖ do so often wish that Aristotle were now alive again. Questionless, he was so rational and ingenious a man, (not half so obstinate as many of his followers) that upon such probabilities as these, he would quickly have renounced his own principles, and have come over to this side: for in one place, having proposed some questions about the heavens§, which were not easy to be resolved, he sets down this rule; that in difficulties, a man may take a liberty to speak that which seems most likely to him; and in such cases, an aptness to guess at some resolution, for the satisfying of our philosophical thirst, does deserve rather to be stiled by the name of modesty, than boldness. And in another place¶, he refers the reader to the different opinions of astronomers, advising him to examine their several tenets, as well Eudoxus as Calippus; and to entertain that (not which is most ancient, but) which is most exact and

* Præf. ad Narrat. Rhetici. † Ibid. ‡ In narratione.
‖ Myst. Cosmogr. c. 1. item Præf. ad 4. l. Astr. Copern.
§ De Cœl. l. 2. c. 12. ¶ Met. lib. 12. cap. 8.

agreeable to reason. And as for Ptolomy, it is his counsel*, that we should endeavour to frame such suppositions of the heavens, as might be more simple, being void of all superfluities: and he confesses, that his hypothesis had many implications in it, together with sundry intricate and unlikely turnings; and therefore in the same place; he seems to admonish us, that we should not be too confident the heavens were really in the same form wherein astronomers did suppose them. So that it is likely, it was his chief intent to propose unto us such a frame of the celestial bodies, from which we might, in some measure, conceive of their different appearances; and according to which, we might be able to calculate their motions. But now it is Copernicus's endeavour, to propound unto us the true natural causes of these several motions and appearances: it was the intent of the one, to settle the imagination; and of the other, to satisfy the judgment. So that we have no reason to doubt of his assent unto this opinion, if he had but clearly understood all the grounds of it.

It is reported of Clavius, that when lying upon his deathbed, he heard the first news of those discoveries which were made by Galilæus's glass, he brake forth into these words: *videre astronomos, quo pacto constituendi sunt orbes cælestes, ut hæc phænomena salvari possint*; that it did behove astronomers to consider of some other hypothesis, beside that of Ptolomy, whereby they might solve all those new appearances. Intimating that this old one, which formerly he had defended, would not now serve the turn: and doubtless, if he had been informed how congruous all these might have been unto the opinion of Copernicus, he would quickly have turned on that side. It is considerable, that amongst the followers of Copernicus, there are scarce any who were not formerly against him; and such, as at first had been thoroughly seasoned with the principles of Aristotle; in which, for the most part, they have no less skill than those who are so violent in the defence of them.

* Alm. l. 13. cap. 2.

Whereas on the contrary, there are very few to be found amongst the followers of Aristotle and Ptolomy, that have read any thing in Copernicus, or do fully understand the grounds of his opinion; and I think, not any, who having been once settled with any strong assent on this side, that have afterwards revolted from it. Now if we do but seriously weigh with ourselves, that so many ingenious, considering men, should reject that opinion which they were nursed up in, and which is generally approved as the truth; and that for the embracing of such a paradox as is condemned in schools, and commonly cried down, as being absurd and ridiculous; I say, if a man do but well consider all this, he must needs conclude, that there is some strong evidence for it to be found out by examination; and that in all probability, this is the righter side.

7. It is probable, that most of those authors who have opposed this opinion, since it hath been confirmed by new discoveries, were stirred up thereunto by some of these three insufficient grounds.

1. An over-fond and partial conceit of their proper inventions. Every man is naturally more affected to his own brood, than to that of which another is the author; though perhaps it may be more agreeable to reason. It is very difficult for any one, in the search of truth, to find in himself such an indifferency, as that his judgment is not at all swayed by an over-weaning affection unto that which is proper unto himself. And this perhaps might be the first reason that moved the noble Tycho with so much heat to oppose Copernicus, that so he might the better make way for the spreading of that hypothesis which was of his own invention. To this I might likewise refer that opinion of Origanus and Mr. Carpenter, who attribute to the earth only a diurnal revolution. It does more especially concern those men that are leaders of several sides, to beat down any that should oppose them.

2. A servile and superstitious fear of derogating from the authority of the ancients, or opposing that meaning of scripture-phrases, wherein the supposed infallible church hath

for a long time understood them. It is made part of the new creed, set forth by Pius the Fourth, 1564. That no man should assent unto any interpretation of scripture, which is not approved of by the authority of the fathers. And this is the reason why the jesuits, who are otherwise the greatest affectors of those opinions which seem to be new and subtil, do yet forbear to say any thing in defence of this; but rather take all occasions to inveigh against it. One of them*, does expressly condemn it for a heresy. And since him, it hath been called in by two sessions of the cardinals†, as being an opinion both absurd and dangerous. And therefore likewise do they punish it, by casting the defenders of it into the pope's truest purgatory, the inquisition: but yet neither these councils, nor any (that I know of) since them, have proceeded to such a peremptory censure of it, as to conclude it a heresy; fearing perhaps, lest a more exact examination, and the discovery of future times, finding it to be an undeniable truth, it might redound to the prejudice of their church, and its infallibility. And therefore he that is most bitter against it, in the heat and violence of opposition, will not call it a heresy: the worst that he dares say of it, is, that it is *opinio temeraria quæ altero saltem pede intravit hæresios limen*‡: a rash opinion, and bordering upon heresy. Though unto this likewise he was incited by the eagerness of disputation, and a desire of victory; for it seems many eminent men of that church before him, were a great deal more mild and moderate in their censures of it.

Paul the Third was not so much offended at Copernicus, when he dedicated his work unto him.

The cardinal of Cusa does expressly maintain this opinion.

Schonbergius, the cardinal of Capua, did with much importunity and great approbation, beg of Copernicus the commentaries that he writ in this kind; and it seems the

* Serrarius Commen. in Jos. cap. 10. quæst. 14. So Lipsius, Physiol. l. 2.

† Ann. Dom. 1616. item 1633. ‡ Fromondus, Antarist. cap. 6.

fathers of the council of Trent were not such confident defenders of Ptolomy's hypothesis against Copernicus, as many now are. For, speaking of those intricate subtilties which the fancies of men had framed to maintain the practice of the church, they compared them to astronomers, who, say they, do feign excentrics and epicicles, and such engines of orbs, to save the phænomena; though they know there are no such things. But now, because this opinion of Copernicus in later times hath been so strictly forbidden and punished, it will concern those of that religion, to take heed of meddling in the defence of it, but rather to submit the liberty of their reason under the command of their superiors, and (which is very absurd) even in natural questions, not to assent unto any thing but what authority shall allow of.

3. A judging of things by sense rather than by discourse and reason: a tying of the meaning of scripture to the letter of it, and from thence concluding philosophical points, together with an ignorance of all those grounds and probabilities in astronomy, upon which this opinion is bottomed. And this, in all likelihood, is the reason why some men, who in other things perhaps are able scholars, do write so vehemently against it; and why the common people in general do cry it down, as being absurd and ridiculous. Under this head I might refer the opposition of Mr. Fuller, Al. Ross. &c.

But now, no prejudice that may arise from the bare authority of such enemies as these, will be liable to sway the judgment of an indifferent considering man; and I doubt not but that he who will thoroughly weigh with himself these particulars that are here propounded, may find some satisfaction for these arguments, which are taken from the seeming novelty and singularity of this opinion.

PROP. II.

That there is not any place in scriptures, from which (being rightly understood) we may infer the diurnal motion of the sun or heavens.

IT were happy for us, if we could exempt scripture from philosophical controversies: if we could be content to let it be perfect for that end unto which it was intended, for a rule of our faith and obedience; and not stretch it also to be a judge of such natural truths as are to be found out by our own industry and experience. Though the Holy Ghost could easily have given us a full resolution of all such particulars; yet he hath left this travel to the sons of men to be exercised therewith*: *mundum reliquit disputationibus hominum*: that being busied for the most part in an inquisition after the creatures, we might find the less leisure to wait upon our lusts, or serve our more sinful inclinations.

But however, because our adversaries generally do so much insult in those arguments that may be drawn from hence; and more especially, because Pineda† doth for this reason with so many bitter and empty reproaches, revile our learned countryman, Dr. Gilbert; in that renewing of this opinion, he omitted an answer to the scripture expressions: therefore it is requisite, that in the prosecution of this discourse, we should lay down such satisfaction as may clear all doubts that may be taken thence: especially since the prejudice that may arise from the misapprehension of those scripture phrases, may much disable the reader from looking on any other argument with an equal and indifferent mind.

The places that seem to oppose this, are of two kinds. First, such as imply a motion in the heavens: or, secondly, such as seem to express a rest and immobility in the earth.

* Eccles. iii. 10, 11. † Comment. in Eccles. ch. i. ver. 4.

Those of the first kind seem to bear in them the clearest evidence, and therefore are more insisted on by our adversaries. They may be referred unto these three heads.

1. All those scriptures where there is any mention made of the rising or setting of the sun or stars.

2. That story in Joshua, where the sun standing still is reckoned for a miracle.

3. That other wonder in the days of Hezekiah, when the sun went back ten degrees in the dial of Ahaz. All which places do seem to conclude, that the diurnal motion is caused by the heavens.

To this I answer in general;

That the Holy Ghost in these scripture expressions, is pleased to accommodate himself unto the conceit of the vulgar, and the usual opinion: whereas, if in the more proper phrase it had been said, that the earth did rise and set; or, that the earth stood still, &c. the people who had been unacquainted with that secret in philosophy, would not have understood the meaning of it; and therefore it was convenient that they should be spoken unto in their own language.

Ay, but you will reply, it should seem more likely, if there had been any such thing, that the Holy Ghost should use the truest expressions: for then he would at the same time have informed them of the thing, and reformed them in an error: since his authority alone had been sufficient to have rectified the mistake.

I answer:

1. Though it were, yet it is beside the chief scope of those places, to instruct us in any philosophical points, as hath been proved in the former book; especially when these things are neither necessary in themselves, nor do necessarily induce to a more full understanding of that which is the main business of those scriptures. But now the people might better conceive the meaning of the Holy Ghost, when he does conform himself unto their capacities and opinions, than when he talks exactly of things in such a proper phrase as is beyond their reach: and therefore it

is said in Isaiah, I am the Lord which teacheth thee *utilia*, profitable things: where the Gloss has it, *non subtilia*, not such curiosities of nature as are not easily apprehended.

2. It is not only besides that which is the chief purpose of those places, but it might happen also to be somewhat opposite unto it. For men being naturally unapt to believe any thing that seems contrary to their senses, might upon this begin to question the authority of that book which affirmed it, or at least to retch scripture some wrong way, to force it to some other sense, which might be more agreeable to their own false imagination. Tertullian* tells us of some heretics, who when they were plainly confuted out of any scripture, would presently accuse those texts or books to be fallible, and of no authority; and rather yield scripture to be erroneous, than forego those tenets for which they thought there was so good reason. So likewise might it have been in these points which seem to bear in them so much contradiction to the senses and common opinion: and therefore it is excellent advice set down by St. Austin†, *Quod nihil credere de re obscurâ temere debemus, ne forte quod postea veritas patefecerit, quamvis libris sanctis sive testamenti veteris, sive novi, nullo modo esse possit adversum, tamen propter amorem nostri erroris oderimus:* that we should not hastily settle our opinions concerning any obscure matter, lest afterwards, the truth being discovered, (which, however it may seem, cannot be repugnant to any thing in scripture) we should hate that, out of love to the error that we have before entertained. A little reading may inform us how those texts have been abused to strange and unmeant allegories, which have mentioned any natural truth in such a manner as was not agreeable to men's conceits. And besides, if the Holy Ghost had propounded unto us any secrets in philosophy, we should have been apt to be so busied about them, as to neglect other matters of greater importance. And therefore St. Austin‡ proposing the question, what should be the reason, why the scripture

* Præscript. c. 17. † In Genes. ad lit. l. 2. in fine. ‡ Ibid. cap. ix.

does not clearly set down any thing concerning the nature, figure, magnitude and motion of the heavenly orbs; he answers it thus: the Holy Ghost being to deliver more necessary truths, would not insert these, lest men, according to the pravity of their dispositions, should neglect the more weighty matters, and bestow their thoughts about the speculative natural points, which were less needful. So that it might seem more convenient that the scripture should not meddle with the revealing of these unlikely secrets, especially when it is to deliver unto us many other mysteries of greater necessity, which seem to be directly opposite to our sense and reason. And therefore, I say, the Holy Ghost might purposely omit the treating of these philosophical secrets, till time and future discovery might with leisure settle them in the opinion of others: as he is pleased in other things of a higher kind, to apply himself unto the infirmity of our apprehensions, by being represented, as if he were a human nature, with the parts and passions of a man. So in these things likewise, that he might descend to our capacities, does he vouchsafe to conform his expressions unto the error and mistake of our judgments.

But before we come to a further illustration, let us a little examine those particular scriptures which are commonly urged to prove the motion of the sun or heavens. These (as was said) might be distributed under these three heads.

1. Those places which mention the rising or setting of the sun; as that in the psalm*, *The sun like a bridegroom cometh out of his chamber, and rejoiceth as a giant to run his race: his going forth is from the end of heaven, and his circuit unto the end of it, and there is nothing hid from the heat thereof.* And that in Ecclesiastes†, *The sun ariseth, and the sun goeth down*, &c.

In which scriptures we may observe divers phrases that are evidently spoken in reference to the appearance of things, and the false opinion of the vulgar. And therefore it is not altogether unlikely, that this, which they seem to

* Psal. xix. 5, 6. † Eccles. i. 5.

affirm concerning the motion of the heavens, should also be understood in the same sense.

The sun like a bridegroom cometh out of his chamber; alluding perhaps unto the conceit of ignorant people: as if it took rest all the while it was absent from us, and came out of its chamber when it arose.

And rejoiceth as a giant to run his race; because in the morning it appears bigger than at other times; and therefore in reference to this appearance, may then be compared unto a giant.

His going forth is from the end of heaven, and his circuit unto the ends of it. Alluding again unto the opinion of the vulgar: who not apprehending the roundness of the heavens, do conceive it to have two ends, one where the sun riseth, the other where it setteth.

And there is nothing hid from the heat thereof; speaking still in reference to the common mistake, as if the sun were actually hot in itself; and as if the heat of the weather were not generated by reflection, but did immediately proceed from the body of the sun.

So likewise, for that in Ecclesiastes, where it is said, *the sun riseth, and the sun goeth down,* &c. which phrases being properly understood, do import that he is sometimes in a higher place than at others: whereas, in a circumference, there is no place higher or lower, each part being at the same distance from the centre, which is the bottom. But now understand the phrase in reference to the sun's appearance, and then we grant that he does seem sometimes to rise, and sometimes to go down, because in reference to the horizon, (which common people apprehend to be the bottom, and in the utmost bounds of it to join with the heavens,) the sun does appear in the morning to rise up from it, and in the evening to go down unto it. Now, I say, because the Holy Ghost, in the manner of these expressions, does so plainly allude unto vulgar errors, and the false appearance of things; therefore it is not without probability, that he should be interpreted in the same sense, when he seems to imply a motion in the sun or heavens.

2. The second place was that relation in Joshua; where it is mentioned as a miracle, that the sun did stand still. And Joshua said*, *Sun, stand thou still upon Gibeon, and thou moon in the valley of Ajalon. So the sun stood still in the midst of heaven, and hasted not to go down about a whole day. And there was no day like that, before it, or after it.* In which place likewise there are divers phrases wherein the Holy Ghost does not express things according to their true nature, and as they are in themselves; but according to their appearances, and as they are conceived in common opinion. As,

1. When he says, *Sun, stand thou still upon Gibeon,* or *over Gibeon.* Now the whole earth being so little in comparison to the body of the sun, and but as a point, in respect of that orb wherein the sun is supposed to move; and Gibeon being, as it were, but a point of this globe of earth; therefore the words cannot be understood properly, but according to appearance. It is probable that Joshua was then at Azecha, a little east from Gibeon, and the sun being somewhat beyond the meridian, did seem unto him as he was in that place, to be over against Gibeon; and in reference to this appearance, and vulgar conceit, does he command it to stand still upon that place†.

2. And so secondly for that other expression; *and thou moon in the valley of Ajalon.* This planet was now a little east from the sun, it being about three or four days old (as commentators‡ guess.) Ajalon was three miles from Gibeon eastward, and Joshua commanded the moon to stand still there; because unto him it did then seem to be over against that valley; whereas, it is certain, if he had been there himself, it would still have seemed to be as much distant from him. Just as men commonly speak in shewing another the stars: we point to a star over such a chimney, or such a tree, because to us it appears so;

* Jos. x. 12, 14. Galilæus maintains the literal sense of this place, towards the end of that treatise, which he calls, Nov. Antiq. pat. doctrina.

† Tostat. in locum, quæst. 16, 17. Arius Montanus in locum.

‡ Tostat. ib. quæst. 18. Serrarius in Josh. 10. quæst. 21, 22.

whereas the star in itself is not sensibly more over them, than it is over us. So that in this phrase likewise the Holy Ghost doth conform himself unto the appearance of things, and our grosser conceit.

3. *And the sun stood still in the midst of heaven.* Now to speak properly, and as the thing is in itself, heaven has no midst but the centre; and therefore this also must be interpreted in reference to the opinion of the vulgar; and by the midst of heaven, we are to understand such a place as was not very near to either of the ends, the east or west.

4. *And there was no day like that, before it, or after it:* which words are not to be understood absolutely, for there are always longer days under the poles; but in respect to the opinion of the vulgar; that is, there was never any day so long which these ignorant people knew of.

3. As for this last place concerning the sun's returning ten degrees in the dial of Ahaz*: I think it may probably be affirmed, that it is to be understood only concerning the shadow: which though it do necessarily happen in all horizontal dials, for any latitude betwixt the tropics: and so consequently in all declining dials, the elevation of whose pole is less than the sun's greatest declination; as Clavius de Horol. cap. 21. observes: yet the circumstances of this relation in scripture, make the event to differ from that other which is common and natural: which against its nature did seem to go backwards, when as the sun itself was not in the least manner altered from its usual course. Of this opinion were Abarbinel, Arius Montanus, Burgensis, Vatablas Sanctius, &c.

The reasons for it may be these;

1. The miracle is proposed only concerning the shadow; Wilt thou that the shadow shall ascend or return by ten degrees? there being not in the offer of this wonder, any the least mention made concerning the sun's going backwards.

2. It is likely we should have had some intimation concerning the extraordinary length of the day, as it is in that

* 2 Kings xx. 11. Isa. xxxviii. 8.

of Joshua; but in this relation, the chief matter that the story takes notice of, is the alteration of the shadow.

3. Had it been by the supposed return of the sun's body, this had been a greater miracle than those which were performed upon more solemn occasions; it had been more wonderful than its seeming rest in Joshua's time; than the supernatural eclipse at our Saviour's death, when the moon was in the full. And then it is not likely, that the Holy Ghost in relating of this miracle, should chiefly insist in expressing how the shadow returned, and that only in the dial of Ahaz.

4. This sign did not appear in the sun itself; because in the 2 Chron. xxxii. 31. it is said, that the ambassadors of the king of Babylon did come unto Hezekiah, to enquire of the wonder that was done in the Lord; and therefore it seems the miracle did not consist in any change of the heavens.

5. If it had been in the sun, it would have been as well discerned in other parts of the world, as in the land of Judea. And then,

1. What need the king of Babylon send thither to enquire after it? If you reply, because it was occasioned by Hezekiah's recovery; I answer, it is not likely that the heathens would ever believe so great a miracle should be wrought merely for a sign of one man's recovery from a disease: but would rather be apt to think that it was done for some more remarkable purpose, and that by some of their own gods, unto whom they attributed a far greater power than unto any other. It is more probable, they might hear some flying rumour of a miracle that was seen in Judea: which because it happened only in Hezekiah's house and dial, and that too upon his recovery from a dangerous sickness, they might be more apt to believe that it was a sign of it.

2. Why have we no mention made of it in the writings of the ancients? It is no way likely, that so great a miracle as this was (if it were in the sun) should have been passed over in silence; especially, since it happened in those later

times, when there were many heathen writers that flourished in the world; Hesiod, Archilochus, Symonides; and not long after, Homer, with divers others; and yet none of them have the least mention of any such prodigy. We have many relations of matters that were less observable, which were done about that time; the history of Numa Pompilius, Gyges; the fight betwixt the three brethren, with divers such stories. And it is scarce credible, that this should have been omitted amongst the rest.

Nay, we have (as many guess) some hints from profane antiquity, of the miracle wrought by Joshua. Unto which, it is thought the ancients did allude in the fable of Phaeton; when the sun was so irregular in his course, that he burnt some part of the world. And questionless then, this which happened in later times, would not have been so wholly forgotten. It is an argument urged by Origen*, that the eclipse at our Saviour's passion was not universal, because no profane author of those times mentions it. Which consequence is the very same with that which is urged in this other case; but by the way, his antecedent was false, since Tertullian† affirms, that it was recorded amongst the Roman annals.

Now as for that story in Herodotus‡, where after he had related the flight of Senacherib, he tells us, how the sun did four times in the space of 10340 years invert his course, and rise in the west; which would seem so unto other nations, if he had only returned, as many conclude, from this scripture: as for this story, (I say) it cannot well be urged as pertinent to the present business, because it seems to have reference unto times that never were.

So that all these things being well considered, we shall find it more probable, that this miracle doth consist in the return of the shadow.

If you object, that the scripture does expressly say, the sun itself returned ten degrees‖; I answer, it is a frequent

* Tractat. 35. in Mat. † Apologet. c. 21.
‡ Lib. 2. ‖ Isa. xxxviii. 8.

manner of speech in scripture, to put the cause for the effect; as that in Jonas*, where it is said, that the sun did beat upon the head of Jonas; that is, the beams of the sun. So that of the Psalmist†, the sun shall not smite thee by day, that is, the heat which proceeds from the sun's reflection. In the same sense may the phrase be understood in this place; and the sun may be said to return back, because the light, which is the effect of it, did seem to do so; or rather, because the shadow, which is the effect of that, did change its course.

This later scripture then, will not at all make to the present purpose: as for those of the two former kinds, I have already answered, that they are spoken in reference to the appearance of things, and vulgar opinion. For the further illustration of which, I shall endeavour to confirm these two particulars.

1. That the Holy Ghost in many other places of scripture, does accommodate his expressions unto the error of our conceits: and does not speak of divers things as they are in themselves, but as they appear unto us. Therefore it is not unlikely, that these phrases also may be liable unto the same interpretation.

2. That divers men have fallen into great absurdities, whilst they have looked for the grounds of philosophy from the words of scripture; and therefore it may be dangerous in this point also, to adhere so closely unto the letter of the text.

* Jonah iv. 8. † Psalm cxxi. 6.

PROP. III.

That the Holy Ghost, in many places of scripture, does plainly conform his expressions unto the errors of our conceits; and does not speak of divers things as they are in themselves, but as they appear unto us.

THERE is not any particular by which philosophy hath been more endamaged, than the ignorant superstition of some men: who in stating the controversies of it, do so closely adhere unto the mere words of scripture. *Quam plurima occurrunt in libris sacris ad naturam pertinentia*, &c. They are the words of Vallesius* "There are sun-"dry things in holy writ concerning natural points, which "most men think are not so to be understood, as if the "Holy Ghost did intend to unfold unto us any thing in "that kind: but referring all to the salvation of our souls, "does speak of other matters according to common opi-"nion." And a little after, *Ego, divina hæc eloquia*, &c. "I for my part am persuaded, that these divine treatises "were not written by the holy and inspired penmen, for "the interpretation of philosophy, because God left such "things to be found out by men's labour and industry. "But yet whatsoever is in them concerning nature is most "true: as proceeding from the God of nature, from whom "nothing could be hid." And questionless, all those things which the scripture does deliver concerning any natural point, cannot be but certain and infallible, being understood in that sense, wherein they were first intended; but now that it does speak sometimes according to common opinion, rather than the true nature of the things themselves, was intimated before; wherefore (by the way) Fromondus† his triumph upon the latter part of this quotation, is but vain, and to no purpose. It is a good rule set down

* Præem. ad Phil. sacram. † Vest. tract. 3. c. 2.

by a learned commentator*, to be observed in the interpretation of scripture: *scriptura sacra sæpe non tam ad veritatem ipsam, quam ad hominum opinionem, sermonem accommodat*; that it does many times accommodate its expressions, not so much to the truth itself, as to men's opinions. And in this sense is that speech of Gregory concerning images and pictures, attributed by Calvin† unto the history of the creation; viz. *librum esse ideotarum*, that it is a book for the simpler and ignorant people. For it being written to inform them, as well as others, it is requisite that it should use the most plain and easy expressions. To this purpose likewise is that of Mersennus‡, *mille sunt scriptura loca* &c. "There are very many places of scripture, which "are not to be interpreted according to the letter; and "that for this reason, because God would apply himself "unto our capacity and sense‖:" *presertim in iis, quæ ad res naturales, oculisque subjectas pertinent*; more especially in those things which concern nature, and are subject to our eyes. And therefore in the very same place, though he be eager enough against Copernicus, yet he concludes that opinion not to be a heresy; because (saith he) those scriptures which seem to oppose it, are not so evident, but that they may be capable of another interpretation: intimating, that it was not unlikely they should be understood in reference to outward appearance and common opinion; and that this manner of speech is frequently used in many other places of scripture, may be easily manifest from these following examples.

Thus though the moon may be proved by infallible observations, to be less than any of the visible stars; yet because of its appearance, and vulgar opinion, therefore doth the scripture in comparison to them, call it one of the great lights. Of which place, saith Calvin§, *Moses populariter scripsit, nos potius respexit quam sydera.* Moses did not

* Sanctius in Isa. xiii. 5. Item in Zachar. l. 9. n. 45.

† Comment. in Gen. c. i. ‡ In Gen. cap. i. ver. 10. art. 6.

‖ Vid. Hiero. in Jer. 28. Aquinas in Job xxvi. 7.

§ Gen. i. 16. Psal. cxxxvi. 7.

so much regard the nature of the thing, as our capacity; and therefore uses a popular phrase: so as ordinary people without the help of arts and learning, might easily understand him; and in another place, *non fuit spiritus sancti concilium astrologiam docere* *: "It was not the purpose "of the Holy Ghost to teach us astronomy: but being to "propound a doctrine that concerns the most rude and "simple people, he does (both by Moses and the prophets) "conform himself unto their phrases and conceits: lest "any should think to excuse his own ignorance with the "pretence of difficulty: as men commonly do in those "things which are delivered after a learned and sublime "manner." Thus Zanchy † likewise, *Moses majorem rationem habuit nostri humanique judicii*, &c. "When Moses "calls the moon a great light, he had a more especial refe-"rence to men's opinions of it, than to the truth of the "thing itself; because he was to deal with such, who do "usually judge rather by their sense than by their reason." Nor will that distinction of Fromondus and others avoid this interpretation, when he tells us of *magnum materiale*, which refers to the bulk and quantity of the body; and *magnum formale*, which imports the greatness of its light. For we grant, that it is really unto us a greater light than any of the stars, or than all of them together: yet there is not one of them, but is in itself a bigger light than this: and therefore when we say this speech is to be understood according to its appearance, we do not oppose this to reality: but it is implied, that this reality is not absolute, and in the nature of the thing itself; but only relative, and in reference to us. I may say a candle is a bigger light than a star, or the moon, because it is really so to me. However any one will think this to be spoken, only in relation to its appearance, and not to be understood as if the thing were so in itself. But (by the way) it does concern Fromondus ‡ to maintain the scripture's authority, in revealing of natural

* Comment. in Psal. cxxxvi. † De Oper. Dei. par. 2. l. 6. c. 1.
‡ De Meteor. l. 4. c. 2. art. 5.

secrets; because, from thence it is that he fetches the chief argument for that strange assertion of his, concerning the heaviness of the wind; where Job says*, that God makes the weight for the wind. Thus likewise, because the common people usually think the rain to proceed from some waters in the expansum, therefore doth Moses in reference to this erroneous conceit, tell us of waters above the firmament, and the windows of heaven: of which saith Calvin †, *nimis serviliter literæ se astringunt*, &c. "Such men too "servilely tie themselves unto the letter of the text, who "hence conclude, that there is a sea in the heavens: when "as we know that Moses and the prophets, to accommo- "date themselves unto the capacity of ruder people, do "use a vulgar expression; and therefore it would be a "preposterous course, to reduce their phrases unto the "exact rules of philosophy." Let me add, that from this mistake, it is likely did arise that groundless observation of the ancient Jews, who would not admit any to read the beginning of Genesis, till he was arrived to thirty years of age. The true reason of which was this: not because that book was harder than any other, but because Moses conforming his expression to vulgar conceits, and they examining of them by more exact rules of philosophy, were fain to force upon them many strange allegories, and unnatural mysteries.

Thus also, because for the most part we conceive the stars to be innumerable, therefore doth the Holy Ghost often speak of them in reference to this opinion. So Jeremy ‡, as the host of heaven cannot be numbered, neither the sand of the sea measured, so will I multiply the seed of David. So likewise, when God would comfort Abraham with the promise of a numberless posterity, he bids him look up to heaven, and tells him, that his seed should be like those stars for number ‖; which, saith Clavius §, *intelligendum est secundum communem sententiam vulgi, existi-*

* Job xxviii. 25. † Comment. in Ps. cxlviii. 4. ‡ Jer. xxxv. 22.
‖ Gen. xv. 5. § In 1 cap. Sphæræ.

mantis infinitam esse multitudinem stellarum, dum eas nocte serena confuse intuetur, is to be understood according to the common opinion of the vulgar, who think the stars to be of an infinite multitude, whilst they behold them all (as they seem confused) in a clear night. And though many of our divines do commonly interpret this speech to be a hyperbole; yet being well considered, we shall find that Abraham's posterity, in some few generations, were far more than there are visible stars in the firmament; and of such only does God speak, because he bids Abraham look up to the heavens.

Now all these, even unto six differences of magnitude, are reckoned to be but 1022. True indeed, at the first viewing of the heavens, it may seem an incredible thing that they should be of no greater a number; but the reason of this is, because they appear scattered and confused, so that the eye cannot place them in any such order, as to reckon them up, or take any distinct survey of them. Now it is a known truth, *quod fortius operatur pluralitas partium, ubi ordo abest; nam inducit similitudinem infiniti, et impedit comprehensionem* *; that a plurality of parts without order, has a more strong operation, because it has a kind of seeming infinity, and so hinders comprehension. And then besides, there are more appearances of stars many times, than there are bodies of them: for the eye, by reason of its weakness and disability to discern any thing at so great a distance; as also, because of those beams which proceed from such remote bodies in a twinkling and wavering manner, and so mix and confound themselves at their entrance into that organ; it must needs receive more representations than there are true bodies. But now, if a man do but leisurely and distinctly compare the stars of the heaven with those of this number that are noted in a celestial globe, he shall scarce find any in the sky which are not marked with the globe; nay, he may observe many in the globe, which he can scarce at all discern in the heavens.

* Sir Fr. Bac. Table of Colours, No. 5.

Now this number of the stars is commonly distributed into 48 constellations; in each of which, though we should suppose ten thousand stars, (which can scarce be conceived) yet would not all this number equal that of the children of *Israel.* Nay, it is the assertion of Clavius*, that Abraham's posterity in some few generations were far more than there could be stars in the firmament, though they stuck so close that they touched one another. And he proves it thus: a great circle in the firmament does contain the diameter of a star of the first magnitude 14960 times. In the diameter of the firmament, there are contained 4760 diameters of such a star: now if we multiply this circumference by this diameter, the product will be 71209600, which is the full number of stars, that the eighth sphere (according to Ptolemy's grounds) would contain, if they stood so close that they touched one another.

The children of *Israel* were reckoned at their going out of Egypt 603550†, of such as were one and twenty years old and upwards, and were able to go to war; besides children, and women, and youths, and old men, and the Levites; which in probability, did always treble the other number. Now if they were so many at one time, we may well conceive that in all those several generations, both before and since, the number was much augmented; and long before this time, did far exceed this supposed multitude of the stars. From all which, we may infer, that the scripture expressions in this kind, are to be understood according to appearance and common opinion.

Another place usually cited for the same purpose, to shew that the Holy Ghost does not speak exactly concerning natural secrets, is that in the Kings and Chronicles‡, which relates unto us the measure of Solomon's brazen sea, whose diameter was ten cubits, and its circumference thirty; whereas to speak geometrically, the more exact proportion betwixt the diameter and the circumference, is not as ten to thirty, but rather as seven to twenty-two.

* In prim. ca. Sphæræ. † Num. i. 46.
‡ 1 King. vii. 23. 2 Chr. iv. 2

But against this it is objected[1] by our adversaries,

1. This sea was not perfectly round, but rather inclining to a semicircular form, as Josephus[2] affirms.

I reply: if it were so, yet this is so much from helping the matter, that it makes it much worse; for then the disproportion will be far greater.

But secondly, scripture, which is to be believed before Josephus, does tell us in express terms, that it was round all about, 1 Kings vii. 23.

2. The proportion of the diameter to the circumference, is not exactly the same as seven to two and twenty, but rather less[3]. I answer, though it be, yet it is nearer unto that, than any other number.

3. The scripture does but, according to its usual custom, suppress the less number, and mention only that which is bigger and more full[4]. So in some places[5], Abraham's posterity is said to remain in the land of Egypt for four hundred years; when as notwithstanding, other scriptures tell us[6], that they tarried there thirty years longer. Thus likewise in one place[7], the number of Jacob's house who came into Egypt, is reckoned to be seventy; whereas elsewhere[8] they are said to be seventy-five.

I answer: all this is so far from destroying the force of the present argument, that it does rather confirm it, and more clearly evidence unto us, that the scripture does not only, not speak exactly in these subtle and more secret points of philosophy; but also, in the ordinary obvious numbering of things, does conform unto common custom, and often use the round number for the whole.

4. It is yet objected by another adversary[9], that we have no reason to expect the Holy Ghost should reveal unto us this secret in nature; because neither Archimedes, nor any other, had then found it out. I reply, and why then should we think that the scripture must needs inform

[1] Ross. l. 1. sect. 1. c. 8. [2] Antiq. Jud. lib. 8. cap. 2.
[3] Ross. ibid. [4] Ibid. [5] Gen. xv. 13. Acts. vii. 6.
[6] Exod. xii. 41. Gal. iii. 17. [7] Gen. xlvi. 27.
[8] Acts. vii. 4. [9] Fromond. Vesta 4. tract. 3. c. 2.

us of the earth's motion; when as neither Pythagoras, nor Copernicus, nor any else, had then discovered it?

5. In taking the compass of this vessel, they measured somewhat below the brim, where it was narrower than at the top, and so the circumference there might be exactly but thirty cubits: whereof its diameter was ten*.

I answer: it is evident this is a mere shift, there being not the least ground for it in the text. And then besides, why might not we affirm, that the diameter was measured from that place, as well as the circumference? since it is very probable that the Holy Ghost did speak *ad idem*, and not tell us the breadth of one place, and the compass of another. So that all our adversaries evasions cannot well avoid the force of the argument that is taken from this scripture.

Again, common people usually conceive the earth to be such a plain, as in its utmost parts is terminated by the heavens, so that if a man were in the farthermost coasts of it, he might touch the sky. And hence also, they think that the reason why some countries are hotter than others, is, because they lie nearer unto the sun. Nay, Strabo tells us of some philosophers too, who in this point have grossly erred; affirming, that there was a place towards the utmost coasts of Lusitania, where a man might hear the noise that the sun made, as he quenched his beams in his descent to the ocean; which, though it be an absurd mistake, yet we may note, that the Holy Ghost in the expression of these things, is pleased to conform himself unto such kind of vulgar and false conceits; and therefore often speaks of the ends of heaven†, and the ends of the world‡. In this sense, they that come from any far country are said to come from the end of heaven, Isaiah xiii. 5. And in another place, from the side of the heavens, Deut. iv. 32. All which phrases do plainly allude unto the error of vulgar capacities (saith Sanctius§) which hereby is better instructed, than it would be by more proper expressions.

* Fromond. Vesta. 4. tract. 3. c. 2. † Ps. xix. 6. Mat. xxiv. 31.
‡ Ps. xxii. xxvii. &c. § Comment. in Isa. xiii. 5.

Thus likewise, because ignorant people cannot well apprehend how so great a weight as the sea and land should hang alone in the open air, without being founded upon some basis to uphold it; therefore in this respect also does scripture apply itself unto their conceits, where it often mentions the foundations of the earth *. Which phrase, in the letter of it, does manifestly allude unto men's imaginations in this kind.

Thus also the common people usually conceive the earth to be upon the water; because, when they have travelled any way as far as they can, they are at length stopped by the sea. Therefore doth scripture in reference to this, affirm†, that God stretched the earth upon the waters, founded the earth upon the seas, and established it upon the floods. Of which places saith Calvin, *Non disputat philosophice David, de terræ situ; sed populariter loquens, ad rudium captum se accommodat:* It was not David's intent to speak philosophically concerning the earth's situation; but rather by using a popular phrase, to accommodate his speech unto the capacities of the ruder people.

In this sense likewise, are we to understand all those places of scripture, wherein the coasts of heaven are denominated from the relations of before, behind, the right hand, or the left. Which do not imply, saith Scaliger ‡, any absolute difference in such places, but are spoken merely in reference to men's estimations, and the common opinion of those people for whom the scriptures were first penned. Thus because it was the opinion of the Jewish rabbies, that man was created with his face to the east, therefore the Hebrew word קדם signifies *ante*, or the east; אחור *post*, or the west; ימין *dextra*, or the south; שמאל *sinistra*, or the north. You may see all of them put together in that place of Job §: Behold I go forward, and he is not there, and backward, but I cannot perceive him; on the left hand, where he doth work, but I cannot

* Job. xxxviii. 4. Ps. cii. 25. † Ps. cxxxvi. 6. xxiv. 2.
‡ Subtil. Exercit. 67. § Job xxiii. 8. 9.

behold him. He hideth himself on the right hand, that I cannot see him. Which expressions are by some interpreters referred unto the four coasts of heaven, according to the common use of those original words. From hence it is, that many of the ancients have concluded hell to be in the north, which is signified by the left hand: unto which side our Saviour tells us, that the goats shall be divided *. Which opinion likewise seems to be favoured by that place in Job †, where it is said, hell is naked before God, and destruction hath no covering. And presently is added, he stretched out the north over the empty place.

Upon these grounds, St. Jerom interprets that speech of the preacher, Eccles. xi. 3. If the tree falls towards the south, or towards the north, in the place where the tree falleth, there shall it be. Concerning those who shall go either to heaven or hell. And in this sense also do some expound that of Zachary, xiv. 4, where it is said, that the Mount of Olives shall cleave in the midst; half of it shall remove towards the north, and half of it towards the south. By which is intimated, that amongst those Gentiles who shall take upon them the profession of Christ, there are two sorts; some that go to the north, that is, to hell, and others to the south, that is to heaven. And therefore it is (say they) that God so often threatens evil out of the north; and upon this ground it is (saith Besoldus§) that there is no religion that worships that way. We read of the Mahometans, that they adore towards the south; the Jews towards the west; Christians towards the east, but none to the north.

But of this only by the way. However, certain it is that the Holy Ghost does frequently in scripture set forth the several coasts of heaven, by those relative terms of right hand and left hand, &c. which expressions do not denote any real intrinsical difference betwixt those places,

* Mat. xxv. 33. † Job xxxvi. 6, 7.
‡ Jer. i. 14, 15. Item cap. iv. 6. vi. 1. § L. de nat. pop. c. 4.

but are rather fitted for the apprehension of those men, from whose fancy it is that they have such denominations. And though Aristotle * concludes these several positions to be natural unto the heavens; yet his authority in this particular is not available, because he delivers it upon a wrong ground, supposing the orbs to be living creatures, and assisted with intelligences. We may observe, that the meaning of these coasts by the relations of right hand and left hand, &c. is so far from having any ground in the nature of those several places, that these relations are not only variously applied unto them by divers religions (as was said before,) but also by divers arts and professions. Thus because astronomers make their observations toward the south parts of the horizon, where there be most stars that rise and set; therefore do they account the west to be at their right hand, and the east at their left. The cosmographers in taking the latitude of places, and reckoning their several climates must look towards the north pole; and therefore in their phrase, by the right hand is meant the east, and by the left hand, the west: and thus (saith Plutarch †) a e we to understand these expressions in Pythagoras, Plato, Aristotle. The poets count the south to be towards the left, and the north the right hand. Thus Lucan ‡ speaking of the Arabians coming unto Thessaly says:

Ignotum vobis Arabes venistis in orbem:
Umbras mirati nemorum, non ire sinistras.

The augurs taking their observations at the east, count the south to be at their right hand, and the north their left: so that these denominations have not any real ground in the nature of the things, but are imposed upon them by the scripture phrase, in reference to the account and opinion of the Jews.

Thus also, because heretofore it was generally received, that the heart was the principal seat of the faculties§; there-

* De Cœl. l. 2. c. 2. † De plac. Philosoph. l. 2. c. 10.
‡ Lib. 3. § D. Hakwel, Apol. l. 1. c. 1. sect. 2.

fore doth the spirit apply himself unto this common tenent; and in many places, attributes wisdom and understanding to the heart *. Whereas, to speak properly, the reason and discursive faculties have their principal residence in the head (saith Galen and Hippocrates, together with the generality of our later physicians,) because they are hindered in their operations by the distempers of that part, and recovered by medicines applied unto it.

So likewise are we to understand those other places, Isa. lix. 5. where some translations read it, *ova aspidum ruperunt*, they have broken the vipers eggs; alluding to that common but fabulous story of the viper, who breaks his passage through the bowels of the female. So Psal. lviii. 4, 5. where the prophet speaks of the deaf adder, that stops her ears against the voice of the charmer. Both which relations (if we may believe many naturalists) are as false as they are common; and yet because they were entertained with the general opinion of those days, therefore doth the Holy Ghost vouchsafe to allude unto them in holy writ. It is a plain mistake of Fromondus †, when in answer to these places, he is fain to say, that they are used proverbially only, and do not positively conclude any thing. For when David writes these words, that they are like the deaf adder which stoppeth her ears, &c. this affirmation is manifestly implied, that the deaf adder does stop her ears against the voice of the charmer: which because it is not true in the letter of it, (as was said before) therefore it is very probable that it should be interpreted in the same sense wherein here it is cited.

In reference to this also, we are to conceive of those other expressions; Cold cometh out of the north; Job xxxvii. 9. and again, Fair weather comes out of the north, ver. 22. So ver. 17. Thy garments are quieted when he warmeth the earth by the south wind. And Prov. xxv. 23. The north wind driveth away rain. Which phrases do not

* Prov. viii. 5. x. 8. Eccles. i. 13, 16, 17. and viii. 5.

† Vesta Trac. 3. cap. 3.

contain in them any absolute general truth, but can so far only be verified, as they referred to several climates: and though unto us who live on this side of the line, the north wind be coldest and driest; and on the contrary, the south wind moist and warm, by reason that in one of these places there is a stronger heat of the sun to exhale moist vapours, than in the other; yet it is clean otherwise with the inhabitants beyond the other tropic; for there the north wind is the hottest, and moist, and the south the coldest, and dry: so that with them, these scriptures cannot properly be affirmed, that cold or that fair weather cometh out of the north; but rather on the contrary. All which notwithstanding, does not in the least manner derogate from the truth of these speeches, or the omnisciency of the speaker, but do rather shew the wisdom and goodness of the blessed spirit, in vouchsafing thus to conform his language unto the capacity of those people unto whom these speeches were first directed: in the same sense are we to understand all those places where the lights of heaven are said to be darkened, and the constellations not to give their light, Isa. xiii. 10*. Not as if they were absolutely in themselves deprived of their light, and did not shine at all; but because of their appearance to us; and therefore in another place answerable to these, God says, he will cover the heavens, and so make the stars thereof dark, Ezek. xxxvii. 2. Which argues, that they themselves were not deprived of this light (as those other speeches seem to imply) but we.

In reference to this likewise are we to conceive of those other expressions, that the moon shall blush, and the sun be ashamed, Isa. xxiv. 23. That they shall be turned into blood, Matth. xxiv. 29. Not that these things shall be so in themselves (saith St. Jerom†,) but because they shall appear so unto us. Thus also Mark xiii. 25. The stars shall fall from heaven; that is, they shall be so wholly covered from our sight, as if they were quite fallen from their wonted places. Or if this be understood of their real fall, as it

* Joel ii. 31. item iii. 15. † Comment. in Joel, c. 3.

may seem probable by that place in the Revelations, vi. 13. And the stars of heaven fell unto the earth, even as a fig-tree casteth her untimely figs, when she is shaken by a mighty wind: then is it to be interpreted not of them that are truly stars, but them that appear so: alluding unto the opinion of the unskilful vulgar (saith Sanctius[1]) that think the meteors to be stars. And Mersennus[2] speaking of the same scripture, says, *hoc de veris stellis minime volunt interpretes intelligi, sed de cometis et aliis ignitis meteoris:* interpreters do by no means understand this of true stars, but of the comets and other fiery meteors. Though the falling of these be a natural event, yet may it be accounted a strange prodigy, as well as an earthquake, and the darkening of the sun and moon, which are mentioned in the verse before.

In reference to this, doth the scripture speak of some common natural effects, as if their true causes were altogether inscrutable, and not to be found out, because they were generally so esteemed by the vulgar. Thus of the wind it is said[3], that none know whence it cometh, nor whither it goeth. In another place[4] God is said to bring it out of his treasures; and elsewhere[5] it is called the breath of God[6]; and so likewise of the thunder: concerning which, Job[7] proposes this question, the thunder of his power who can understand? and therefore too David[8] does so often stile it, the voice of God. All which places seem to imply, that the cause of these things was not to be discovered, which yet later philosophers pretend to know: so that according to their construction, these phrases are to be understood in relation unto their ignorance unto whom these speeches were immediately directed[9].

For this reason is it; why, though there be in nature many other causes of springs and rivers than the sea, yet Solomon (who was a great philosopher, and perhaps not

[1] Commen. in Isa. c. xiii. 5.
[2] Comment. in Gen. c. iii. v. 10. ar. 6.
[3] Joh. iii. 8.
[4] Jer. x. 13. item li. 16.
[5] נשם
[6] Job xxxvii. 10.
[7] Jo. xxvi. 14.
[8] Psal. ii. 9. iii. 4, &c.
[9] Eccles. i. 7.

ignorant of them) does mention only this; because most obvious, and easily apprehended by the vulgar *. Unto all these scriptures, I might add that in Amos v. 8. which speaks of the constellation commonly called the seven stars; whereas later discoveries have found that there are but six of them discernible to the bare eye, as appears by Galilæus his glass †: the seventh of them being but a deceit of the eye, arising from their too great nearness; and if a man try in a clear night to number them distinctly, he shall find that there will sometimes appear but six, and sometimes more.

True indeed, the original word of this scripture כימה, does not necessarily imply any such number in its signification, but yet our English translation renders it the seven stars; and if it had been expressly so in the original too, it might have spoken true enough, because they are usually esteemed of that number. And when it had been said, he made the seven stars and Orion, we might have easily understood the words thus: he made those constellations that are commonly known unto us under such names.

From all these scriptures it is clearly manifest, that it is a frequent custom for the Holy Ghost to speak of natural things, rather according to their appearance and common opinion, than the truth itself. Now it is very plain, and our enemies themselves do grant it, that if the world had been framed according to the system of Copernicus ‡, *futurum esset ut vulgus, de solis motu et terræ statu proinde ut nunc loqueretur.* The vulgar phrase would have been the same as now it is, when it speaks of the sun's motion, and the earth's standing still.

Wherefore it is not improbable, that such kind of scripture-expressions are to be understood only in relation to outward appearances, and vulgar opinion.

* Job ix. 9. item. xxxviii. 31.

† Vide Fromond. Met. l. 3. c. 1. art. 1. ‡ Fromond. Ant. c. 6.

PROP. IV.

That divers learned men have fallen into great absurdities, whilst they have looked for the sects of philosophy from the words of scripture.

IT has been an ancient and common opinion amongst the Jews, that the law of Moses did contain in it, not only those things which concern our religion and obedience, but every secret also that may possibly be known in any art or science*; so that there is not a demonstration in geometry, or rule in arithmetic; not a mystery in any trade, but it may be found out in the Pentateuch. Hence it was (say they) that Solomon had all his wisdom and policy: hence it was that he did fetch his knowledge concerning the nature of vegetables, from the cedar of Lebanon, to the hyssop that grows upon the wall. Nay from hence, they thought a man might learn the art of miracles, to remove a mountain, or recover the dead. So strangely have the learneder sort of that nation been befooled, since their own curse hath lighted upon them.

Not much unlike this foolish superstition of theirs, is that custom of many artists amongst us; who upon the invention of any new secret, will presently find out some obscure text or other to father it upon, as if the Holy Ghost must needs take notice of every particular which their partial fancies did over-value.

Nor are they altogether guiltless of this fault, who look for any secrets of nature from the words of scripture; or will examine all its expressions by the exact rules of philosophy.

Unto what strange absurdities this false imagination of the learneder Jews hath exposed them, may be manifest by a great multitude of examples. I will mention only some few of them. Hence it is that they prove the shin-bone of

* Schickard. Bechin. Hapern. Disp. 5. Num. 8.

Og the giant to be above three leagues long*; or (which is a more modest relation) that Moses being fourteen cubits in stature, having a spear ten ells in length, and leaping up ten cubits, could touch this giant but on the ancle. All which they can confirm unto you by a cabalistical interpretation of this story, as it is set down in scripture. Hence it is that they tell us of all those strange beasts which shall be seen at the coming of the Messias†: as first, the ox, which Job calls Behemoth, that every day devours the grass on a thousand mountains, as you may see it in the psalm‡, where David mentions the cattle, or בהמות upon a thousand hills. If you ask how this beast does to find pasture enough, they answer, that he remains constantly in one place, and where there is as much grass grows up in the night, as was eaten in the day.

They tell us also of a bird, which was of that quantity, that having upon a time cast an egg out of her nest, there were beaten down by the fall of it three hundred of the tallest cedars, and no less than threescore villages drowned. As also of a frog as big as a town capable of sixty houses; which frog, notwithstanding his greatness, was devoured by a serpent, and that serpent by a crow; which crow, as she was flying up to a tree, eclipsed the sun, and darkened the world; by which you may guess what a pretty twig that tree was. If you would know the proper name of this bird, you may find it in Psal. l. 11. where it is called עוף, or in our translation, the fowl of the mountains||. It seems it was somewhat of kin to that other bird they tell us of, whose legs were so long, that they reached unto the bottom of that sea, where there had been an axe-head falling for seven years together, before it could come to the bottom.

Many other relations there are, which contain such horrible absurdities, that a man cannot well conceive how they should proceed from reasonable creatures. And all this arising from that wrong principle of theirs, that scripture

* Schickard. ib. Disp. 6. num. 2. † Buxtor. Synag. Juda. c. 36.
‡ Psal. l. 10. || Vide Parap. Chald.

did exactly contain in it all kind of truths; and that every meaning was true, which by the letter of it, or by cabalistical interpretations might be found out.

Now as it hath been with them, so likewise hath it happened in proportion unto others, who by a superstitious adhering unto the bare words of scripture, have exposed themselves unto many strange errors. Thus St. Basil [1] holds, that next to the sun, the moon is bigger than any of the stars, because Moses does call them only two great lights.

Thus others maintain, that there are waters properly so called, above the starry firmament, because of these vulgar expressions in scripture, which in their literal sense do mention them. Of this opinion were many of the ancients, Philo, Josephus, and since them the fathers Justin Martyr [2], Theodoret [3], Austin [4], Ambrose [5], Basil [6], and almost all the rest. Since them sundry other learned men, as Beda, Strabo, Damascen, Tho. Aquinas, &c. If you ask for what purpose they were placed here, Justin Martyr tells us, for these two ends: first, to cool the heat that might otherwise arise from the motion of the solid orbs; and hence it is, say they, that Saturn is colder than any of the other planets, because though he move faster, yet he is nearer to these waters. Secondly, to press and keep down the heavens, lest the frequency and violence of winds might break and scatter them asunder: which opinion, together with both its reasons, are now accounted absurd and ridiculous.

St. Austin [7] concludes the visible stars to be innumerable, because scripture phrases seem to imply as much.

That the heavens are not round, was the opinion of Justin Martyr [8], Ambrose [9], Chrysostom [10], Theodoret [11], Theophilact [12], doubted of by St. Austin [13], and divers others. Nay, St. Chrysostom was so confident of it, that he pro-

[1] Enarrat. in Gen. [2] Respons. ad Ques. 93. Orthod.
[3] Que. 11. sup. Gen. [4] De Civ. Dei, lib. 11. cap. ult.
[5] Hexam. l. 2. c. 2. [6] Homil. 3. in Gen. [7] Civ. Dei, l. 16. c. 23.
[8] Respon. ad Quest. 93. [9] Hexam. l. 1. c. 6.
[10] Homil. 14. in Ep. ad Hebr. [11] In c. 8. Hebr.
[12] In id. c. [13] In Gen. ad lit. l. 1. c. 9. item. l. 2. c. 6.

poses the question in a triumphant manner: Πυ εισιν οι σφαιροειδη ουρανον ειναι αποφαινομενοι; Where are those men that can prove the heavens to have a spherical form? The reason of which was this, because it is said in one scripture, that God stretched forth the heavens as a curtain, Psal. civ. 2. and spreadeth them as a tent to dwell in, Isa. xl. 22. and so in that place of the epistle to the Hebrews, viii. 2. they are called, a tent or tabernacle: which because it is not spherical, therefore they conclude also, that the heavens are not of that form; whereas now, the contrary is as evident as demonstration can make a thing. And therefore, St. Jerom[1] in his time, speaking of the same error, gives it this plain censure: *est in ecclesia stultiloquium, si quis cœlum putet fornicis modo curvatum, Esaiæ quem non intelligit sermone deceptus.* It is foolish speaking in the church, if any through misapprehension of those words in Isaiah, shall affirm the heavens not to be round.

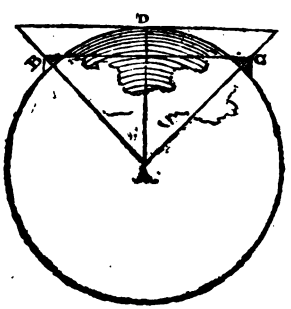
That the seas not overflowing the land is a miracle, was the opinion of Basil[2], Chrysostom[3], Theodoret[4], Ambrose[5], Nazianzen[6], and since them, Aquinas[7], Luther[8], Calvin, Marlorate, with sundry others: which they proved from these scripture expressions: that in Job xxxviii. 8, 11. who hath shut up the sea with doors, when it brake forth, as if it had issued out of the womb; when I did break up for it my decreed place; and set bars, and doors, and said, hitherto shalt thou come, and no further, and here shall the pride of the waves be staid. So likewise, Prov. viii. 29. God gave to the sea his decree, that the waters should not pass his commandment. And Jerem. v. 22. I have placed the sand for a bound of the sea by a perpetual decree, that they cannot pass it; and though the waves thereof toss themselves, yet can they not prevail; though they roar, yet can they not pass over, that they turn not again to cover the earth. In all which places, say they, it is implied, that

[1] Lib. 3. Comment. in Galat. c. 5. [2] Homil. 4. Hexam.
[3] Comment. in Job. [4] In Psal. ciii. [5] Hexam. l. 3. c. 2, 3.
[6] Orat. 34. [7] Aquinas, part 1. quest. 69. art. 1.
[8] Comment. in Psal. xxiv. item in Psal. cxxxvi. 6.

the water of itself, were it not withheld from its own natural inclination by a more special power of God, would overflow the land.

Others infer the same conclusion from that in Ecclesiastes, where the rivers are said to come from the sea, which they could not do, unless that were higher. I answer: they should as well consider the latter part of that scripture, which says, that the rivers return to that place from whence they came, and then the force of this consequence will vanish. To this purpose some urge that speech of our Saviour, where he bids Simeon to launch forth into the deep *; the Latin word is, *in altum*; from whence they gather, that the sea is higher than the land. But this savours so much of monkish ignorance, that it deserves rather to be laughed at, than to be answered.

But now if we consider the true properties of this element, according to the rules of philosophy, we shall find, that its not overflowing the land is so far from being a miracle, that it is a necessary consequence of its nature; and it would rather be a miracle, if it should be otherwise, as it was in the general deluge. The reason is, because the water of itself must necessarily descend to the lowest place; which it cannot do, unless it be collected in a spherical form, as you may plainly discern in this figure.



* Luke v. 4. Εις το Βαθος

Where the sea at D, may seem to be higher than a mountain at B, or C, because the rising of it in the midst, does so intercept our sight from either of those places, that we cannot look in a strait line, from the one to the other. So that it may seem to be no less than a miracle, by which the sea (being a heavy body) was withheld from flowing down to those lower places of B, or C. But now, if you consider that the ascending of a body is its motion from the centre, and descent is its approaching unto it; you shall find, that for the sea to move from D, to B or C, is a motion of ascent, which is contrary to its nature, because the mountains at B, or C, are farther off from the centre, than the sea at D; the lines A B, and A C, being longer than the other A D. So that for the sea to keep always in its channel, is but agreeable to its nature, as being a heavy body. But the meaning of those scriptures is, to set forth the power and wisdom of God; who hath appointed these channels for it, and beset it with such strong banks to withstand the fury of its waves. Or if these men do so much rely in natural points, upon the bare words of scripture, they might easily be confuted from those other places, where God is said to have founded the earth upon the seas, and established it upon the floods. From the literal interpretation of which, many of the ancients have fallen into another error; affirming the water to be in the lower place; and as a basis, whereon the weight of the earth was borne up. Of this opinion were Clemens Alexandrinus*, Athanasius†, Hillary‡, Eusebius‖, and others. So that it seems, if a man should resolutely adhere to the bare words of the scripture, he might find contradiction in it; of which the natural meaning is altogether incapable. St. Jerom§ tells us of some who would prove stars to have understanding, from that place in Isaiah, xlv. 12. My hands have stretched out the heavens, and all their host have I commanded. Now (say they) none but intelligent creatures are capable

* Recog. 8. † Orat. cont. Idolos. ‡ In Psal. cxxxvi. 6.
‖ In Psal. xxiv. § Comment. in Isa. l. 13.

of precepts; and therefore the stars must needs have rational souls. Of this opinion was Philo the Jew*: nay, many of the rabbies conclude, that they do every hour sing praises unto God with an audible real voice †; because of that in Job xxxviii. 7. which speaks of the morning stars singing together. And Psal. xix. 3, 4. where it is said of the heavens, that there is no speech nor language where their voice is not heard, and their words are gone to the ends of the world. And whereas we translate that place in the tenth of Joshua, concerning the standing still of the heavens; the original word, דמם does properly signify silence, and according to their opinion, Joshua did only bid them hold their peace. From such grounds it is likely did Origen‡ fetch his opinion, that the stars should be saved. I might set down many other the like instances, were it not for being already weary of raking into the errors of antiquity, or uncovering the nakedness of our forefathers. That excuse of Acosta || may justly serve to mitigate the mistakes of these ancient divines: *facile condonandum est patribus, si cum cognoscendo colendoque creatori toti vacarent, de creatura minus apte aliqua ex parte opinati sunt.* Those good men were so wholly busied about the knowledge and worship of the creator, that they had not leisure enough for an exact search into the essence of the creatures. However, these examples that have been already cited, may sufficiently manifest how frequently others have been deceived, in concluding the points of philosophy from the expressions of scripture. And therefore it is not certain, but that in the present case also, it may be insufficient for such a manner of arguing.

* De plant. Noe.
† Tostatus in Josh. c. 10. quest. 13, 14.
‡ Tom. 1. in Johan.
|| De nat. novi orbis, l. 1. c. 2.

PROP. V.

That the scripture, in its proper construction, does not any where affirm the immobility of the earth.

THE same answer which was insisted on before, concerning the conformity of scripture expressions to men's capacity and common opinion, may well enough satisfy all those other arguments, which seem thence to affirm the earth's settledness and immobility; since this is as well agreeable to outward appearance and vulgar apprehension as the other. But now for more full satisfaction, I shall set down the particular places that are urged for it; which being thoroughly examined, we may plainly discern that none of them, in their proper meaning, will serve to infer any such conclusion.

One of these sayings is that of the preacher, Eccles. i. 4. One generation cometh, and another passeth, but the earth endureth for ever; where the original word is, עמד, and the vulgar, *stat*; from whence our adversaries* conclude that it is immoveable.

I answer: the meaning of the word, as it is here applied, is permanent; or as we translate it, endureth. For it is not the purpose of this place to deny all kind of motion to the whole earth, but that of generation and corruption, to which other things in it are liable. And though Pineda and others keep a great deal of impertinent stir about this scripture, yet they grant this to be the natural meaning of it: which you may more clearly discern, if you consider the chief scope of this book; wherein the preacher's intent is, to shew the extraordinary vanity of all earthly contentments, ver. 2. the utter unprofitableness of all a man's labour, ver. 3. and this he illustrates by the shortness and un-

* Vallesius Sacra Phil. c. 62. Fuller, Miscell. l. 1. c. 15. Pineda Comment. in locum.

certainty of his life, in which respect he is below many of his fellow creatures, as may be manifested from these four comparisons.

1. From the earth, which though it seem to be but as the sediment of the world, as the rubbish of the creation; yet is this better than man in respect of his lastingness; for one generation passeth away, and another cometh; but the earth that abideth for ever, ver. 4.

2. From the sun; who though he seem frequently to go down, yet he constantly seems to rise again, and shines with the same glory *, ver. 5. but man dieth, and wasteth away, yea, man giveth up the ghost, and where is he? he lieth down, and riseth not till the heavens be no more.

3. From the wind, the common emblem of uncertainty; yet it is more constant than man, for that knows its circuits, and whirleth about continually, ver. 6. whereas our life passeth away as doth the wind, but returneth not again †.

4. From the sea; though it be as uncertain as the moon, by whom it is governed, yet it is more durable than man and his happiness. For though the rivers run into it, and from it, yet it is still of the same quantity that it was at the beginning, ver. 7. but man grows worse as he grows older, and still nearer to a decay, So that in this respect he is much inferior to many other of his fellow creatures.

From whence it is manifest, that this constancy, or standing of the earth, is not opposed to its local motion, but to the changing or passing away of divers men in their several generations. And therefore thence to conclude the earth's immobility were as weak and ridiculous as if one should argue thus: one miller goes, and another comes, but the mill remains still; ergo, the mill hath no motion ‡.

Or thus: one pilate goes, and another comes, but the ship remains still; *ergo*, the ship does not stir.

R. Moses || tells us, how that many of the Jews did from this place conclude, that Solomon thought the earth to be

* Job xiv. 10, 12. † Psal. lxxviii. 39.
‡ Mr. Carpenter's Geog. l. 1. c. 4. || Perplex. l. 2. c. 29.

eternal, because he saith it abideth לעולם for ever; and questionless, if we examine it impartially, we shall find that the phrase seems more to favour this absurdity, than that which our adversaries would collect from hence, that it is without motion.

But Mr. Fuller urging this text against Copernicus, tells us, if any should interpret these phrases concerning the earth's standing still, ver. 4. and the sun's motion, ver. 5. in reference only to appearance, and common opinion; he must necessarily also understand those two other verses which mention the motion of the wind and rivers in the same sense. As if he should say; because some things appear otherwise than they are, therefore every thing is otherwise than it appears: or, because scripture speaks of some natural things, as they are esteemed according to man's false conceit, therefore it is necessary that every natural thing mentioned in scripture must be interpreted in the like sense: or, because in one place we read of the ends of a staff, 1 Kings viii. 8. and in many other places of the ends of the earth, and the ends of heaven; therefore the earth and heavens have as properly ends as a staff. It is the very same consequence of that in the objection. Because in this place of Ecclesiastes we read with the rest of the earth, and the motion of the sun; therefore these phrases must needs be understood in the same proper construction as those afterwards, where motion was attributed to the wind and rivers. Which inference you see is so weak, that the objector need not triumph so much in its strength as he doth.

Another proof like unto this is taken from St. Peter, Epist. 2. cap. iii. ver. 5. where he speaks of the earth standing out of the water, and in the water, γη συνεστωσα, and therefore the earth is immoveable.

I answer: it is evident that the word here is equivalent with *fuit*; and the scope of the apostle is to shew, that God made all the earth, both that which was above the water, and that which was under it. So that from this expression, to collect the rest and immobility of the earth, would be

such an argument as this other. Such a man made that part of a mill-wheel, or a ship, which stands below the water, and that part which stands above the water; therefore those things are immoveable.

To such vain and idle consequences does the heat of opposition drive our adversaries.

A third argument stronger than either of the former, they conceive may be collected from those scriptures*, where it is said, the world is established, that it cannot be moved.

To which I answer: these places speak of the world in general, and not particularly of our earth; and therefore may as well prove the immobility of the heavens, they being the greatest part of the world; in comparison to which, our earth is but as an insensible point.

If you reply, that the word in these places is to be understood by a synechdoche, as being meant only of this habitable world, the earth:

I answer: first, this is only said, not proved: secondly, David but a little before seems to make a difference between the world and the earth, Psal. xc. 2. where he says, before thou hadst formed the earth and the world. But thirdly, in another place there is the same original word applied expressly to the heavens; and which is yet more, the same place does likewise mention this supposed settledness of the earth, Prov. iii. 19. The Lord by wisdom hath founded the earth; and by understanding hath he established the heavens. So that these places can no more prove an immobility in the earth than in the heavens.

If you yet reply, that by the heavens there is meant the seat of the blessed, which does not move with the rest:

I answer: though by such an evasion a man might possibly avoid the force of this place; yet, first, it is but a groundless shift, because then that verse will not contain a full enumeration of the parts in the world, as may seem more agreeable to the intention of it; but only shew, that God created this earth where we live, and the heaven of

* 1 Chron. xvi. 30. Psal. xciii. 1. item xcvi. 10.

heavens. So that the heaven of the stars and planets shall be shifted out from the number of the other creatures. Secondly, there is another place which cannot be so avoided, Psal. lxxxix. 37. where the Psalmist uses this expression, יכן it shall be established as the moon. So Psal. viii. 4. the moon and the stars, אשר כוננתה which thou hast established. Thus likewise, Prov. viii. 27. when he established the heavens: and in the next verse, our English translation reads it, when he established the clouds. And yet our adversaries will affirm the moon, and stars, and clouds to be subject unto natural motions: why then should the very same expressions be counted as sufficient arguments to take it away from the earth?

If it be replied, that by establishing the heavens, is meant only the holding of them up, that they do not fall down to us (as Lorinus* explains that in the eighth psalm, and quotes Euthymius for the same interpretation;) *fundare verbum significat decidere non posse, aut dimoveri a loco ubi collocata sunt.* I answer, why may not we as well interpret the words thus of the earth; so that by establishing of it, is meant only the keeping of it up in the vast places of the open air, without falling to any other place.

From hence it is plain, that these scriptures are to be understood of such an immobility in the earth, as may likewise agree with the heavens: the same original word being so promiscuously applied to both.

Ay, but (you will say) there are some other places which do more peculiarly apply this settledness and establishment to the earth. So Psal. cxix. 90. Thy faithfulness is unto all generations: Thou hast established the earth, and it abideth. Thus likewise, Psal. civ. 5. Who laid the foundations of the earth, that it should not be moved for ever. The latter of which, being well weighed in its original (saith Mr. Fuller†) does in three emphatical words strongly conclude the earth's immobility.

As first, when he says יסד *fundavit*, he hath founded it;

* Lorinus Comment. in Psal. viii. † Miscel. l. 1. cap. 15.

wherein it is implied, that it does not change his place. To which may be added all those texts, which so frequently speak of the foundations of the earth; as also that expression of the Psalmist, where he mentions the pillars of the earth, Psal. lxxv. 3.

The second word is מכונה translated basis; and by the Septuagint, επι την ασφαλειαν αυτης; that is, he hath founded it upon its own firmness; and therefore it is altogether without motion.

The third expression is בל־תמוט from the root מוט which signifies, *declinare*; implying, that it could not wag with the least kind of declination.

To these I answer severally:

First, for the word, יסד fundavit, it cannot be understood properly, as if the natural frame of the earth, like other artificial buildings, did need any bottom to uphold it; for he hangeth the earth upon nothing, Job xxvi. 7. But it is a metaphor, and signifies God's placing or situating this globe of land and water. As David tells us of the pillars of the earth; so Job mentions pillars of the heavens, Job xxvi. 11. and yet that will not prove them to be immoveable.

True indeed, we read often concerning the foundations of the earth: but so we do likewise of the ends, sides, and corners of the earth; and yet these scriptures will not prove it to be of a long or square form. Besides, we read also of the foundations of heaven, מוסדות, 2 Sam. xxii. 8. And yet we must not hence infer, that they are without all motion: as also of the planting of the heavens, Isa. li. 6. which may as well prove them to be immoveable, as that which follows in the same verse concerning the foundations of the earth.

Which phrase (if I have observed right) in several places of scripture, is to be understood according to these three interpretations.

1. It is taken sometimes for the lower parts of the earth, as appears by that place, 2 Sam. xxii. 16. The channels of the sea appeared, the foundations of the world were discovered*.

* So Psal. xviii. 15.

2. Sometimes for the beginning and first creation of it. Isa. xl. 2. Hath it not been told you from the beginning, have ye not understood from the foundations of the earth? and in many other places, before the foundation of the world was laid*; that is, before the first creation.

3. Sometimes it signifies the magistrates and chief governors of the earth. So, many interpret that place in Micah, where it is said, vi. 2. Hear O ye mountains the Lord's controversy, and ye strong foundations of the earth. So Psal. lxxxii. 5. The foundations of the earth are out of course; and in Sam. ii. 8. they are called pillars. For the pillars of the earth are the Lord's, and he hath set the world upon them. Hence it is, that the Hebrews derive their word for master, or lord, from a root which signifies a basis or bottom. אדון, ab אדן. And the Greek word for king, does in its primitives import as much as the foundation of the people, βασιλευς, *quasi* βασις τȣ λαȣ†. But now, none of all the several interpretations of this phrase, will in the least manner conduce to the confirmation of the present argument.

As for the second word, מכוניה *basis ejus:* I answer, the proper signification of it, is *locus dispositus, sedes,* or *statio,* an appointed seat or station; and according to this sense, is it most frequently used in scripture. And therefore, the heavens are sometimes called מכין the seat of God's habitation. And for this reason likewise, do Aquila and Symmachus translate it by the word ἑδρα, a seat or appointed situation, which may as well be attributed to the heavens.

The third expression is בל תמוט, that it should not be moved, from the primitive מוט, which does not signify barely to move, but *declinare,* or *vacillare,* to decline or slip aside from its usual course. Thus is it used by David, Psal. xvii. 5. where he prays, hold up my goings in thy paths, בל נמטו פעמי that my footsteps slide not: he does not mean that his feet should not move. So Psal. cxxi. 3. He will not suffer thy foot to be moved. Thus likewise, Psal.

* John xvii. 24. Ephes. i. 4. † Etymol. mag.

xvi. 8. Because the Lord is at my right hand, I shall not be moved. Which last place is translated in the New Testament * by the Greek word σαλευω, which signifies *fluctuare*, or *vacillare*, to be shaken by such an uncertain motion as the waves of the sea. Now as David's feet may have their usual motion, and yet in this sense be said not to move, that is, not to decline or slip aside; so neither can the same phrase applied to the earth, prove it to be immoveable.

Nor do I see any reason, why that of Didacus Astunica † may not be truly affirmed, that we may prove the natural motion of the earth, from that place in Job ix. 6. *Qui commovet terram e loco suo*, as well as its rest and immobility from these.

From all which, it is very evident, that each of these expressions, concerning the founding or establishing both of heaven or earth, were not intended to shew the unmoveableness of either; but rather, to manifest the power and wisdom of providence, who had so settled these parts of the world in their proper situations, that no natural cause could displace them, or make them decline from their appointed course. As for such who do utterly dislike all new interpretation of scripture, even in such matters as do merely concern opinion, and are not fundamental, I would only propose unto them a speech of St. Hierom, concerning some that were of the same mind in his time. *Cum novas semper expetant voluptates, et gulæ eorum vicina maria non sufficiant, cur in solo studio scripturarum, veteri sapore contenti sunt.*

Thus have I in some measure cleared the chief arguments from scripture, against this opinion. For which notwithstanding, I have not thence cited any; because I conceive the holy writ, being chiefly intended to inform us of such things as concern our faith and obedience, we cannot thence take any proper proof for the confirmation of natural secrets.

* Act. ii. 25. † Comment. in Job.

PROP. VI.

That there is not any argument from the words of scripture, principles of nature, or observations in astronomy, which can sufficiently evidence the earth to be in the centre of the universe.

OUR adversaries do much insult in the strength of those arguments which they conceive do unanswerably conclude the earth to be in the centre of the world. Whereas, if they were but impartially considered, they would be found altogether insufficient for any such conclusion, as shall be clearly manifested in this following chapter.

The arguments which they urge in the proof of this, are of three sorts; either such as are taken,

1. From expressions of scripture.
2. From principles of natural philosophy.
3. From common appearances in astronomy.

Those of the first kind are chiefly two: the first is grounded on that common scripture-phrase, which speaks of the sun, as being above us. So Solomon often mentioning human affairs, calls them, the works which are done under the sun *. From whence it appears, that the earth is below it, and therefore nearer to the centre of the universe, than the sun.

I answer: Though the sun in comparison to the absolute frame of the world, be in the midst; yet this does not hinder, but that in respect to our earth, he may be truly said to be above it; because we usually measure the height or lowness of every thing, by its being further off, or nearer unto this centre of our earth. From which, since the sun is so remote, it may properly be affirmed that we are under it, though notwithstanding that be in the centre of the world.

* Eccles i. 14, &c.

A second argument of the same kind, is urged by Fromondus.

It is requisite, that hell (which is in the centre of the earth*) should be most remotely situated from the seat of the blessed. But now this heaven, which is the seat of the blessed, is concentrical to the starry sphere: and therefore it will follow, that our earth must be in the midst of this sphere; and so consequently in the centre of the world.

I answer: this argument is grounded upon these uncertainties;

1. That hell must needs be situated in the centre of our earth.

2. That the heaven of the blessed must needs be concentrical to that of the stars.

3. That places must be as far distant in situation as in use.

Which because they are taken for granted, without any proof, and are in themselves but weak and doubtful, therefore the conclusion (which always follows the worser part) cannot be strong, and so will not need any other answer.

The second sort of arguments taken from natural philosophy, are principally these three.

1. First, from the vileness of our earth, because it consists of a more sordid and base matter than any other part of the world; and therefore must be situated in the centre, which is the worst place, and at the greatest distance from those purer incorruptible bodies, the heavens.

I answer: this argument does suppose such propositions for grounds, which are not yet proved, and therefore not to be granted. As,

1. That bodies must be as far distant in places, as in nobility.

2. That the earth is of a more ignoble substance than any of the other planets, consisting of a more base and vile matter.

* Antar. c. 12. item Vesta. tract. 5. c. 2.

3. That the centre is the worst place.

All which are (if not evidently false) yet very uncertain.

2. From the nature of the centre, which is the place of rest, and such as in all circular motions is itself immoveable, and therefore will be the fittest situation for the earth; which by reason of its heaviness, is naturally unfit for motion.

I answer: this argument likewise is grounded upon these two false foundations; as,

1. That the whole frame of nature does move round, excepting only the earth.

2. That the whole earth, considered as whole, and in its proper place, is heavy, or more unfit for a natural motion, than any of the other planets.

Which are so far from being such general grounds from which controversies should be discussed, that they are the very thing in question betwixt us and our adversaries.

3. From the nature of all heavy bodies, which is to fall towards the lowest place. From whence they conclude, that our earth must be in the centre.

I answer: this may prove it to be a centre of gravity, but not of distance, or that it is in the midst of the world. Yea, (but say our adversaries) Aristotle for this urges a demonstration, which must needs be infallible. Thus the motion of light bodies does apparently tend upward towards the circumference of the world: but now the motion of heavy bodies is directly contrary to the ascent of the other; wherefore it will necessarily follow, that these do all of them tend unto the centre of the world.

I answer: though Aristotle were a master in the art of syllogisms, and he from whom we received the rules of disputation; yet in this particular, it is very plain that he was deceived with a fallacy, whilst his argument does suppose that which it does pretend to prove.

That light bodies do ascend unto some circumference which is higher and above the earth, is plain and undeniable. But that this circumference is the same with that of the world, or concentrical unto it, cannot be reasonably

affirmed, unless he suppose the earth to be in the centre of the universe, which is the thing to be proved.

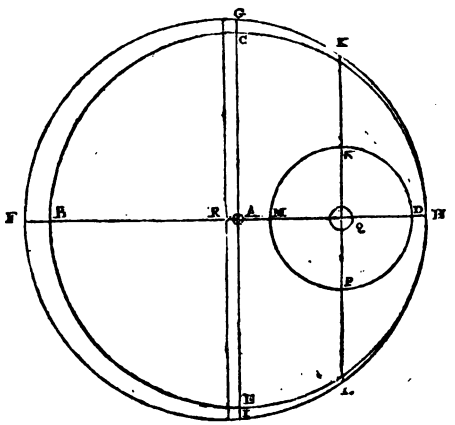
I would fain know from what grounds our adversaries can prove, that the descent of heavy bodies is to the centre; or the ascent of light bodies, to the circumference of the world. The utmost experience we can have in this kind, does but extend to those things that are upon our earth, or in the air above it. And alas! what is this unto the vast frame of the whole universe, but punctulum, such an insensible point, which does not bear so great a proportion to the whole, as a small sand does unto the earth. Wherefore it were a senseless thing, from our experience of so little a part, to pronounce any thing infallibly concerning the situation of the whole. The arguments from astronomy, are chiefly these four; each of which are boasted of to be unanswerable.

1. The horizon does every where divide all the great circles of a sphere into two equal parts; so there is always half the equinoctial above it, and half below. Thus likewise, there will constantly be six signs of the zodiac above the horizon, and other six below it. And besides, the circles of the heaven and earth, are each way proportionable to one another; as fifteen German miles on the earth, are every where agreeable to one degree in the heavens; and one hour in the earth, is correspondent to fifteen degrees in the equator. From whence it may be inferred, that the earth must necessarily be situated in the midst of these circles; and so consequently, in the centre of the world.

I answer: this argument does rightly prove the earth to be in the midst of these circles; but we cannot hence conclude, that it is in the centre of the world: from which, though it were never so much distant, yet would it still remain in the midst of those circles, because it is the eye that imagines them to be described about it. Wherefore it were a weak and preposterous collection, to argue thus, that the earth is in the centre of the world, because in the midst of those circles; or because the parts and degrees of the earth are answerable in proportion to the parts and de-

grees in heaven. Whereas, it follows rather on the contrary, that these circles are equally distant and proportional in their parts, in respect of the earth, because it is our eye that describes them about the centre of it.

So that though a far greater part of the world did appear at one time than at another, yet in respect of those circles which our eye describes about the earth, all that we could see at once, would seem to be but a perfect hemisphere; as may be manifested by this following figure.



Where if we suppose A to be our earth, B C D E one of the great circles which we fancy about it, F G H I the orb of fixed stars, R the centre of them: now though the ark G F I be bigger than the other G H I, yet notwithstanding, to the eye on the earth A, one will appear a semicircle as well as the other; because the imagination does transfer all those stars into the lesser circle B C D E, which it does fancy to be described above that centre. Nay, though there were a habitable earth at a far greater distance from the centre of the world, even in the place of Jupiter, as suppose at Q; yet then also would there be the same appearance. For though the ark K F L in the starry heaven, were twice as big as the other K H L, yet notwithstanding at the earth Q they would both appear but as equal hemi-

spheres, being transferred into that other circle M N O P, which is part of the sphere that the eye describes to itself about that earth.

From whence we may plainly discern, that though the earth be never so far distant from the centre of the world, yet the parts and degrees of that imaginary sphere about it, will always be proportional to the parts and degrees of the earth.

2. Another demonstration like unto this former, frequently urged to the same purpose, is this. If the earth be out of the centre of the world, then must it be situated in one of these three positions: either in the equator, but out of the axis; or 2dly, in the axis, but out of the equator; or 3dly, besides both of them. But it is not placed according to any of these situations, therefore must it needs be in the centre *.

1. It is not in the equator, and beside the axis: for then, 1st, there will be no equinox at all in some places, when the days and nights shall be of an equal length; 2dly, the afternoons and forenoons will not be of the same length; because, then our meridian line must divide the hemisphere into unequal parts.

2. It is not in the axis, but out of the equator; for then, first, the equinox would not happen when the sun was in the middle line betwixt the two solstices, but in some other parallel, which might be nearer to one of them, according as the earth did approach to one tropic more than another. Secondly, there would not be such a proportion between the increase and decrease of days and nights, as now there is.

3. It is not besides both of them: for then, all these inconveniencies, and sundry others must with the same necessity of consequence be inferred. From whence it will follow, that the earth must be situated there where the axis and equator meet, which is in the centre of the world.

To this we grant, that the earth must needs be placed

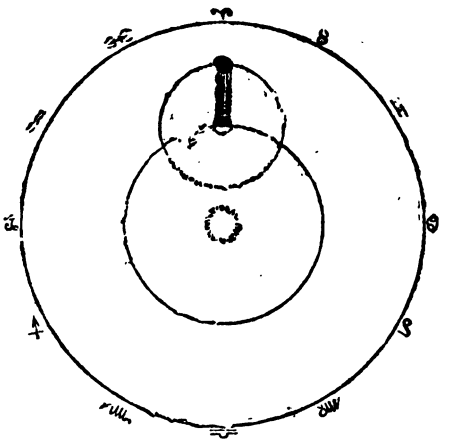
* Vid. Carp. Geog. l. 1. c. 5.

both in the axis and equator; and so consequently, in the centre of that sphere which we imagine about it. But yet this will not prove, that it is in the midst of the universe: for let our adversaries suppose it to be as far distant from that, as they conceive the sun to be; yet may it still be situated in the very concourse of these two lines; because the axis of the world is nothing else, but that imaginary line which passes through the poles of our earth, to the poles of the world. And so likewise the equator is nothing else but a great circle in the midst of the earth, betwixt both the poles, which by imagination is continued even to the fixed stars. Thus also, we may affirm the earth to be in the plane of the zodiac, if by its annual motion it did describe that imaginary circle: and in the plane of the equator, if by its diurnal motion about its own axis, it did make several parallels, the midst of which should be the equator. From whence it appears, that these two former arguments proceed from one and the same mistake; whilst our adversaries suppose the circumference and centre of the sphere, to be the same with that of the world.

Another demonstration of the same kind, is taken from the eclipses of the sun and moon; which would not always happen when these two luminaries are diametrically opposed, but sometimes when they are less distant than a semicircle, if it were so that the earth were not in the centre.

I answer: this argument, if well considered, will be found most directly to infer this conclusion; that in all eclipses, the earth is in such a strait line (betwixt the two luminaries) whose extremities do point unto opposite parts of the zodiac. Now, though our adversaries should suppose (as Copernicus does) the earth to be situated in that which they would have to be the sun's orb; yet would there not be any eclipse, but when the sun and moon were diametrically opposite, and our earth betwixt them; as may clearly be manifested by this figure, where you see the two luminaries in opposite signs: and according as any part of

our earth is situated by its diurnal revolution, so will every eclipse be either visible, or not visible unto it.



The last and chief argument, is taken from the appearance of the stars; which in every horizon, at each hour of the night, and at all times of the year, seem of an equal bigness*. Now this could not be, if our earth were sometimes nearer unto them by 2000000 German miles, which is granted to be the diameter of that orb wherein the earth is supposed to move.

I answer: this consequence will not hold, if we affirm the earth's orb not to be big enough for the making of any sensible difference in the appearance of the fixed stars.

Yea, but (you will say) it is beyond conceit, and without all reason, to think the fixed stars of so vast a distance from us, that our approaching nearer unto them by 2000000 German miles, cannot make any difference in the seeming quantity of their bodies†.

I reply: there is no certain way to find out the exact distance of the starry firmament; but we are fain to con-

* Arist. de cœlo, lib. 2. c. 14. † Copern. l. 1. cap. 5, 6.

clude of it by conjectures, according as several reasons and observations seem most likely unto the fancies of divers men. Now that this opinion of Copernicus does not make it too big, may be discerned from these following considerations.

The words great and little, are relative terms, and do import a comparison to something else: so that where the firmament, (as it is according to Copernicus) is said to be too big, it is likely that this word is to be understood in reference to some other thing of the same kind, the least of which is the moon's orb. But now if its being so much bigger than this, may be a sufficient reason why it should be thought too great, then it seems that every thing which exceeds another of the same kind in such a proportion, may be concluded to be of too big a quantity; and so consequently, we may affirm that there is no such thing in the world. And hence it will follow, that whales and elephants are mere chimæras, and poetical fictions, because they do so much exceed so many other living creatures. If all this eighth sphere, (saith Galilæus) as great as it is, were a light body, and placed so far from us that it appeared but as one of the lesser stars, we should then esteem it but little; and therefore we have no reason now to thrust it out from being amongst the works of nature, by reason of its too great immensity. It is a frequent speech of our adversaries, Tycho, Fromondus, and others, in excuse of that incredible swiftness which they imagine in their *primum mobile*, that it was requisite the motion of the heavens should have a kind of infinity in it, the better to manifest the infiniteness of the creator. And why may not we as well affirm this concerning the bigness of the heavens? *Difficilius est accidens præter modulum subjecti intendere, quam subjectum sine accidente augere* (saith Keplar.) His meaning is, that it is less absurd to imagine the eighth sphere of so vast a bigness, as long as it is without motion, or at least has but a very slow one; than to attribute unto it such an incredible celerity, as is altogether disproportionable to its bigness.

2. It is the acknowledgment of Clavius*, and might easily be demonstrated, that if the centre were fastened upon the pole of the world, the orb wherein he supposes the sun to move would not be able to reach so far in the eighth sphere (being considered according to Ptolemy's hypothesis) as to touch the pole star; which notwithstanding (saith he) is so near the pole itself, that we can scarce discern it to move: nay, that circle which the pole-star makes about the pole, is above four times bigger than the orb of the sun. So that according to the opinion of our adversaries, though our earth were at that distance from the centre, as they suppose the sun to be, yet would not this eccentricity make it nearer to any one part of the firmament, than the pole-star is to the pole; which according to his confession, is scarce sensible. And therefore according to their opinion, it would cause very little difference in the appearance of those stars, the biggest of which does not seem to be of above five seconds in its diameter.

3. It is considerable, that the spheres of Saturn, Jupiter, Mars, are, according to the general opinion, of very great extension; and yet each of them is appointed only to carry about its particular planet, which are but very little in comparison of the fixed stars. Now if for the situation of these fixed stars, there should be allotted a proportionable part of the world, it is certain that their orb must be far bigger than it is commonly supposed, and very near to this opinion of Copernicus.

4. We usually judge the bigness of the higher orbs by their different motions: as because Saturn finishes his course in thirty years, and Jupiter in twelve, therefore we attribute unto those orbs such a different proportion in their bigness. Now if by this rule we would find out the quantity of the eighth sphere, we shall discern it to be far nearer unto that bigness which Copernicus supposeth it to have, than that which Ptolemy, Tycho, and others ordinarily ascribe unto

* Comment. in Sphær. cap. 1.

it: for the starry heaven (say they) does not finish his course under 26000 years; whereas Saturn, which is next unto it, does compass his orb in thirty years. From whence it will probably follow, that there is a very great distance betwixt these in place, because they have such different terms of their revolutions.

But against this answer unto the last argument, our adversaries thus reply:

1. If the fixed stars are so far distant from us, that our approaching nearer unto them by 1000000 German miles, does not make any sensible difference in their appearance; then Galilæus's perspective could not make them seem of a bigger form than they do to the bare eye, which yet is contrary to common experience *.

2. From hence it may be inferred, that the least fixed star is bigger than all this orb wherein we suppose the earth to move; because there is none of them but are of a sensible bigness in respect of the firmament, whereas this it seems is not †.

3. Since God did at first create the stars for the use of all nations that are under the whole heavens, Deut. iv. 19. it might have argued some improvidence in him, if he had made them of such vast magnitudes; whereas they might as well bestow their light and influences, and so consequently be as serviceable to that end for which they were appointed, if they had been made with less bodies, and placed nearer unto us. And it is a common maxim, that nature in all her operations, does avoid superfluities, and use the most compendious way ‡.

I answer:

1. To the first, whether the perspective do make the fixed stars appear bigger than they do to the bare eye, cannot certainly be concluded, unless we had such an exact glass, by which we might try the experiment. But if in this kind we will trust the authority of others, Keplar || tells

* Fromond. Vesta, tract. 5. cap. 1. † Ibid. ‡ Ibid.
|| Astron. Copern. lib. 4. par. 1.

us from the experience of skilful men, that the better the perspective is, by so much the less will the fixed stars appear through it, being but as meer points, from which the beams of light do disperse themselves like hairs. And it is commonly affirmed by others, that the dog-star, which seems to be the biggest star amongst those of the first magnitude, does yet appear through this glass but as a little point no bigger than the fiftieth part of Jupiter. Hence it is, that though the common opinion hold the stars of the first magnitude to be two minutes in their diameter, and Tycho three; yet Galilæus *, who hath been most versed in the experiments of his own perspective concludes them to be but five seconds.

2. To the second: first we affirm, the fixed stars to be of a vast magnitude. But however, this argument does not induce any necessity that we should conceive them so big as the earth's orb. For it might easily be proved, that though a star of the sixth magnitude were but equal in diameter unto the sun (which is far enough from the greatness of the earth's orb;) yet the starry heaven would be at such a distance from us, that the earth's annual motion could not cause any difference in its appearance.

Suppose the diameter of the sun to be about half a degree †, as our adversaries grant; whereas a star of the sixth magnitude is 50 thirds, which is comprehended in that of the sun 2160 times. Now if the sun were removed so far from us, that its diameter would seem but as one of that number whereof it now contains 2160; then must his distance from us be 2160 times greater than now it is: which is all one, as if we should say, that a star of the sixth magnitude is severed from us by so many semidiameters of the earth's orb. But now according to common consent, the distance of the earth from the sun does contain 128 semidiameters of the earth, and (as was said before) this supposed distance of the fixed stars does comprehend 2160 semidiameters of the earth's orb. From whence it is manifest, that the semidiameter of the earth, in com-

* System. Mundi. Coll. 3. † Vid. Gal. ibid.

parison to its distance from the sun, will be almost doubly bigger than the semidiameter of the earth's orb, in comparison to this distance of the stars. But now, the semidiameter of the earth does make very little difference in the appearance of the sun, because we see common observations upon the surface of it, are as exactly true to the sense as if they were made from the centre of it. Wherefore, that difference which would be made in these fixed stars, by the annual course of the earth, must needs be much more unobservable, or rather altogether insensible.

2. The consequence of this argument is grounded upon this false supposition, that every body must necessarily be of an equal extension to that distance from whence there does not appear any sensible difference in its quantity. So that when I see a bird flying such a height in the air, that my being nearer unto it, or farther from it, by ten or twenty foot, does not make it seem unto my eyes either bigger or less; then I may conclude, that the bird must needs be either ten or twenty foot thick: Or when I see the body of a tree that may be half a mile from me, and perceive that my approaching nearer to it by 30 or 40 paces, does not sensibly make any different appearance, I may then infer, that the tree is forty paces thick; with many the like absurd consequences, that would follow from that foundation upon which this argument is bottomed.

To the third I answer: it is too much presumption, to conclude that to be superfluous, the usefulness of which we do not understand. There be many secret ends in these great works of Providence, which human wisdom cannot reach unto; and as Solomon speaks of those things that are under the sun, so may we also of those things that are above it; that no man can find out the works of God; for though a man labour to seek it out, yea further, though a wise man think to know it, yet shall he not be able to find it *. He that hath most insight into the works of nature, is not able to give a satisfying reason, why the

* Eccles. viii. 17.

planets or stars should be placed just at this particular distance from the earth, and no nearer or farther. And besides, this argument might as well be urged against the hypothesis of Ptolemy or Tycho, since the stars, for ought we know, might have been as serviceable to us, if they had been placed far nearer, than either of those authors suppose them. Again, were there any force in such a consequence, it would as well conclude a great improvidence of nature, in making such a multitude of those lesser stars, which have lately been discovered by the perspective. For to what purpose should so many lights be created for the use of man, since his eyes were not able to discern them? So that our disability to comprehend all those ends which might be aimed at in the works of nature, can be no sufficient argument to prove their superfluity. Though scripture do tell us that these things were made for our use, yet it does not tell us, that this is their only end. It is not impossible, but that there may be elsewhere some other inhabitants, by whom these lesser stars may be more plainly discerned. And (as was said before) why may not we affirm that of the bigness, which our adversaries do concerning the motion of the heavens? That God, to shew his own immensity, did put a kind of infinity in the creature.

There is yet another argument to this purpose, urged by Al. Ross *. which was not referred to any of the former kind, because I could scarcely believe I did rightly understand it; since he puts it in the front of his other arguments, as being of strength and subtilty enough to be a leader unto all the rest; and yet in the most likely sense of it, it is so extremely simple to be pressed in a controversy, that every fresh-man would laugh at it. The words of it are these: *Quod minimum est in circulo debet esse centrum illius; at terra longe minor est sole, & æquinoctialis terrestris est omnium in cælo circulus minimus; ergo*, &c.

By the same reason, it would rather follow, that the

* Lib. 1. sect. 2. c. 1.

moon or Mercury were in the centre, since both these are less than the earth. And then, whereas he says that the æquinoctial of the earth is the least circle in the heavens, it is neither true nor pertinent, and would make one suspect, that he who should urge such an argument, did scarce understand any thing in astronomy.

There are many other objections like unto this, not worth the citing: the chief of all have been already answered; by which you may discern, that there is not any such great necessity as our adversaries pretend, why the earth should be situated in the midst of the universe.

PROP. VII.

It is probable that the Sun is in the centre of the world.

THE chief reasons for the confirmation of this truth, are implied in the conveniences of this hypothesis above any other; whereby we may resolve the motions and appearances of the heavens into more easy and natural causes.

Hence will the frame of nature be freed from that deformity which it has according to the system of Tycho; who though he make the sun to be in the midst of the planets, yet without any good reason denies it to be in the midst of the fixed stars; as if the planets, which are such eminent parts of the world, should be appointed to move about a distinct centre of their own, which was beside that of the universe.

Hence likewise are we freed from many of those inconveniences in the hypothesis of Ptolemy, who supposed in the heavens, epicycles and eccentrics, and other orbs, which he calls the deferents of the apoge and perige. As if nature in framing this great engine of the world, had been put unto such hard shifts, that she was fain to make use of wheels and screws, and other the like artificial instruments of motion.

There be sundry other particulars, whereby this opinion concerning the sun's being in the centre, may be strongly evidenced; which because they relate unto several motions also, cannot therefore properly be insisted on in this place. You may easily enough discern them, by considering the whole frame of the heavens, as they are according to the system of Copernicus, wherein all those probable resolutions that are given for divers appearances amongst the planets, do mainly depend upon this supposition, that the sun is in the centre. Which arguments (were there no other) might be abundantly enough for the confirmation of it. But for the greater plenty, there are likewise these probabilities considerable.

1. It may seem agreeable to reason, that the light which is diffused in several stars, through the circumference of the world, should be more eminently contained, and (as it were) contracted in the centre of it, which can only be by placing the sun there.

2. It is an argument of Clavius.*, and frequently urged by our adversaries, That the most natural situation of the sun's body was in the midst, betwixt the other planets; and that for this reason, because from thence he might more conveniently distribute amongst them both his light and heat. The force of which may more properly be applied to prove him in the centre.

3. It is probable that the planetary orbs (which are special parts of the universe) do move about the centre of the world, rather than about any other centre which is remote from it. But now it is evident that the planets Saturn, Jupiter, Mars, Venus, Mercury, do by their motion encompass the body of the sun. It is likely therefore that this is situated in the midst of the world.

As for the three upper planets, it is found by observation, that they are always nearest to the earth when in opposition to the sun, and farthest from us when in conjunction with it; which difference is so eminent, that Mars in his perige

* In prim. c. Spher.

does appear sixty times bigger than when he is in the apoge, and at the greatest distance.

Now, that the revolution of Venus and Mercury also is about the sun, may from hence be evidenced: First, because they are never at any great distance from him. Secondly, because they are seen sometimes above, and sometimes below him. Thirdly, because Venus, according to her different situation, does change her appearance as the moon.

4. There is yet another argument, which Aristotle * himself does repeat from Pythagoras. The most excellent body should have the best place; but the sun is the most excellent body, and the centre is the best place; therefore it is likely the sun is in the centre. In the frame of nature (which is supposed to be of an orbicular form) there are but two places of any eminency, the circumference and the centre. The circumference being of so wide a capacity, cannot so fitly be the peculiar seat of a body, that is so little in respect of it: and besides, that which is the most excellent part of the world, should be equally preserved in itself, and shared in its virtues by all the other parts, which can only be done by its being placed in the midst of them. This is intimated unto us in that frequent speech of Plato, that the soul of the world does reside in the innermost place of it; and that in Macrobius †, who often compares the sun in the world to the heart in a living creature.

Unto this Aristotle answers by a distinction: there is *medium magnitudinis*, so the centre is the middle of a sphere, and there is *medium naturæ*, or *informationis*, which is not always the same with the other; for in this sense the heart is the middle of a man; because from thence (saith he) as from the centre, the vital spirits are conveyed to all the members: and yet we know that it is not the centre of magnitude, or at an equal distance from all the other parts.

And besides, the middle is the worst place, because most circumscribed, since that is more excellent which does

* De Cœlo, l. 2. c. 13. † Saturnal. l. 1. c. 17, &c.

limit any thing, than that which is bounded by it. For this reason is it, that matter is amongst those things which are terminated, and form, that which does circumscribe.

But against this answer of Aristotle, it is again replied:

1. Though it be true, that in living creatures the best and chiefest part is not placed always just in the midst, yet this may be, because they are not of an orbicular form, as the world is *.

2. Though that which bounds another thing be more excellent than that which is terminated by it, yet this does not prove the centre to be the worst place, because that is one of the terms or limits of a round body, as well as the circumference.

There are likewise other arguments to this purpose, much insisted on by eminent astronomers †, taken from that harmonical proportion which there may be betwixt the several distance and bigness of the orbs, if we suppose the sun to be in the centre.

For according to this (say they) we may conceive an excellent harmony both in the number and the distance of the planets: (and if God made all other things *numero & mensurâ*, much more then those greater works, the heavens); for then the five mathematical bodies, so much spoken of by Euclid ‡, will bear in them a proportion answerable to the several distances of the planets from one another.

Thus a cube will measure the distance betwixt Saturn and Jupiter; a pyramis or tetraëdron, the distance betwixt Jupiter and Mars; a dodecaëdron, the distance betwixt Mars and the earth; an icosaëdron, the distance betwixt the earth and Venus; and an octaëdron the distance betwixt Venus and Mercury; that is, if we conceive a circumference described immediately without the cube, and another within it, the distance between these two will shew what proportional distance there is betwixt the orb of Saturn and that of

* Keplar, Astr. Copern. l. 4. part 2.

† Mæslin. præ. ad Narrat. Rhetici, Keplar, Mysterium Cosmographicum.

‡ Lib. 13. prop. 14, 15, &c.

Jupiter. Thus also if you conceive a circumference described on the outside of a pyramis or tetraëdron, and another within it, this will shew such a proportional distance as there is betwixt the orb of Mars from that of Jupiter. And so of the rest.

Now if any ask why there are but six planetary orbs? Keplar answers: *Quia non oportet plures quàm quinque proportiones esse, totidem nempè quot regularia sunt in mathesi corpora. Sex autèm termini consummant hunc proportionum numerum.* Because there are but five proportions, so many as there are regular bodies in mathematics, each of whose sides and angles are equal to one another. But now there are six terms required to consummate this number of proportions; and so consequently, there can be but six primary planets.

Thus likewise by placing the sun in the centre, we may conceive such a proportion betwixt the bodies of the planets, as will be answerable unto their several spheres: then Mercury, which has the least orb, will have the least body; Venus bigger than that, but less than any of the other; our earth bigger than Venus, but less than the rest; Mars bigger than the earth, but less than Jupiter; Jupiter bigger than Mars, and less than Saturn; Saturn being the highest, should also be the biggest. All which harmony would be disturbed by putting in the sun amongst them; and therefore it may be more convenient for him to sit still in the centre.

There are sundry other arguments in this kind to be found out, by a consideration of this whole hypothesis: He that does rightly understand it, may therein easily discern many strong probabilities, why the sun should be in the midst of the world, rather than in any other position.

PROP. VIII.

That there is not any sufficient reason to prove the earth incapable of those motions which Copernicus ascribes unto it.

THE two chief motions in the world, which are more especially remarkable above the rest, are the diurnal, and annual.

The diurnal, which makes the difference betwixt night and day, is caused by the revolution of our earth upon its own axis, in the space of four and twenty hours.

The annual, which makes the difference betwixt winter and summer, is likewise caused by the earth, when being carried through the ecliptic in its own orb, it finishes its course in a year.

The first is usually stiled, *motus revolutionis:* the second, *motus circumlationis:* there is likewise a third, which Copernicus calls, *motus inclinationis:* but this being thoroughly considered, cannot properly be stiled a motion, but rather an immutability, it being that whereby the axis of the earth does always keep parallel to itself, from which situation it is not his annual course that does make it in the least manner to decline.

As for the difficulties which concern the second of these, they have been already handled in the sixth proposition, where the earth's eccentricity was maintained.

So that the chief business of this chapter, is to defend the earth's diurnal motion, against the objections of our adversaries. Sundry of which objections, to speak (as the truth is) do bear in them a great shew of probability, and such too (as it seems) was very efficacious; since Aristotle and Ptolemy, &c. Men of excellent parts and deep judgments did ground upon them, as being of infallible and necessary consequence.

I shall reckon them up severally, and set down such answers unto each, as may yield some satisfaction to every indifferent seeker of truth.

1. First then, it is objected from our senses; if the earth did move, we should perceive it. The western mountains would then appear to ascend towards the stars, rather than the stars to descend below them.

I answer: the sight judges of motion according as any thing does desert the plain whereon itself is seated; which plain everywhere keeping the same situation and distance, in respect of the eye, does therefore seem immoveable unto it, and the motion will appear in those stars and parts of the heaven, through which the vertical line does pass.

The reason of such deceit may be this: motion being not a proper object of the sight, nor belonging to any other peculiar sense, must therefore be judged of by the *sensus communis*, which is liable to mistake in this respect; because it apprehends the eye itself to rest immoveable, whilst it does not feel any effects of this motion in the body: as it is when a man is carried in a ship; so that sense is but an ill judge of natural secrets. It is a good rule of Plato, Εις τον νεν αφορεν δει φιλοσοφον και μη εις την οψιν: a philosopher must not be carried away by the bare appearance of things to sight, but must examine them by reason. If this were a good consequence, the earth does not move, because it does not appear so to us, we might then as well argue, that it does move when we go upon the water, according to the verse:

Provehimur portu, terræque, urbesque recedunt.

Or if such arguments would hold, it were an easy matter to prove the sun and moon not so big as a hat, or the fixed stars as a candle.

Yea, but if the motion of the heavens be only apparent, and not real, then the motion of the clouds will be so too, since the eye may be as well deceived in the one as the other *.

I answer: it is all one, as if he should infer that the sense was mistaken in every thing, because it was so in one

* Al. Ross. l. 1. sect. 1. c. 1.

thing: and this would be an excellent argument to prove that opinion of Anaxagoras, that the snow was black.

The reason why that motion which is caused by the earth does appear as if it were in the heavens, is, because the *sensus communis* in judging of it, does conceive the eye to be itself immoveable (as was said before) there being no sense that does discern the effects of any motion in the body; and therefore it does conclude every thing to move, which it does perceive to change its distance from it: so that the clouds do not seem to move sometimes, when as notwithstanding they are everywhere carried about with our earth, by such a swift revolution; yet this can be no hindrance at all, why we may not judge aright of their other particular motions, for which there is not the same reason. Though to a man in a ship, the trees and banks may seem to move, yet it would be but a weak argument, to conclude from hence, that therefore such a one could not tell whether his friend does really stir, whom he sees to walk up and down in the ship: or that he might as well be deceived in judging the oars to move when they do not

It is again replied by the same objector *, that it is not credible the eye should be mistaken in judging of the stars and heavens; because those being light bodies, are the primary and proper objects of that sense.

I answer: the deceit here is not concerning the light or colour of those bodies, but concerning their motion; which is neither the primary nor proper object of the eye, but reckoned amongst the *objecta communia.*

2. Another common argument against this motion, is taken from the danger that would thence arise, unto all high buildings, which by this would quickly be ruinated, and scattered abroad.

I answer: this motion is supposed to be natural; and those things which are according to nature, have contrary effects to other matters, which are by force and violence †. Now it belongs unto things of this latter kind to be incon-

* Al. Ross. l. 1. sect. 1. c. 1. † Coper. l. 1. c. 8.

sistent and hurtful; whereas those of the first kind must be regular, and tending to conservation. The motion of the earth is always equal and like itself; not by starts and fits. If a glass of beer may stand firmly enough in a ship, when it moves swiftly upon a smooth stream, much less then will the motion of the earth, which is more natural, and so consequently more equal, cause any danger unto those buildings that are erected upon it. And therefore to suspect any such event, would be like the fear of Lactantius, who would not acknowledge the being of any antipodes, lest then he might be forced to grant that they should fall down unto the heavens *. We have equal reason to be afraid of high buildings, if the whole world above us were whirled about with such a mad celerity as our adversaries suppose; for then there would be but small hopes that this little point of earth should escape from the rest.

But supposing (saith Rosse †) that this motion were natural to the earth, yet it is not natural to towns and buildings, for these are artificial.

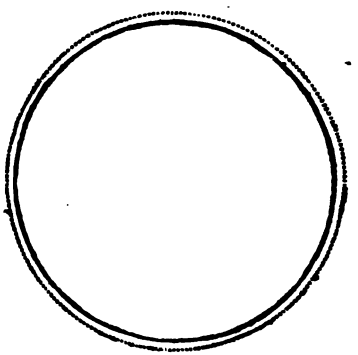
To which I answer: ha, ha, he.

3. Another argument to this purpose is taken from the rest and quietness of the air about us; which could not be, if there were any such swift motion of the earth. If a man riding upon a fleet horse, do perceive the air to beat against his face, as if there were a wind, what a vehement tempest should we continually feel from the east, if the earth were turned about with such a swift revolution as is supposed.

Unto this it is usually answered, that the air also is carried along with the same motion of the earth: for if the concavity of the moon's orb, which is of so smooth and glabrous a superficies, may (according to our adversaries) drive along with it the greatest part of this elementary world, all the regions of fire, and all the vast upper regions of air, and (as some will have it) the two lower regions, together with the sea likewise; for from hence (saith Alex. Rosse, l. 1. sect. 1. c. 3.) is it, that betwixt the tropics there is a constant

* Gilbert de Magn. l. 6. c. 5. † Lib. 1. sect. 1. c. 3.

eastern wind, and a continual flowing of the sea westward: I say, if the motion of the heavens, which are smooth bodies, may be able to carry with it so great a part of the elementary world: or if the rugged parts of the moon's body be able to carry with it so great a part of the air, as Fromondus (Ant. c. 16.) affirms; much more then may our earth, which is a rugged mountainous body, be able to turn about so little a part of the world, as that vaporous air next unto it.



Suppose the inward circle to represent the earth; and the outward the thicker air, which encompasses it. Now it is easily conceivable, that the revolution of so great a body as this globe of earth, may turn about by its mere motion (if there were nothing else) so little a part of the adjoining air, as is here represented: and yet,

1. The disproportion betwixt the thickness of the earth, and this orb of air, is far greater than could be expressed in the figure, being but as twenty miles; which is at most the thickness of this air, unto 3456 miles, which is the semidiameter of our earth, and so is but as an insensible number in respect of this other.

2. Besides the mere motion of the earth, which in probability (being such a rugged body) might be enough to carry so little a part of the air along with it; there is also (as we suppose) a magnetical vigour which proceeds from it,

whereby it is more able to make all things that are near unto it, to observe the same revolution.

But if it be so (saith Alex. Ross*.) that not only the man, but the medium also, and the object be moved: this must needs be such a great hindrance to the sight, that the eye cannot judge exactly of any thing. For, suppose the man alone to be in a motion, he could not see so well as when he is still; but now if not only he, but his spectacles and book were all moved, he would not be able to discern any thing distinctly.

I answer: the consequence were pertinent, if all these were several motions; but if the subject, and medium, and object, were all carried with one and the same equal motion, (as it is here supposed) this could be no impediment to the act of seeing, but it would be all one with the rest; because by this means, they are not severed from one another, and therefore the species are not disturbed. It is an excellent saying of Galilæus†, and may serve for the resolution of many such doubts as these: *motus eatenus tanquam motus operatur, quatenus relationem habet ad eas res quæ ipso distituuntur, in iis vero rebus, quæ totæ æqualiter de eo participant, nihil operatur, et ita se habet ac si nullus esset.* If a man be within some room of a ship, he may read altogether as easily when the ship moves, as when it stands still.

4. Another argument against this circular motion of the earth, is grounded upon that common principle amongst the Aristotelians: *unius corporis simplicis unus tantum est motus.* One kind of body has but one kind of motion. But now the earth and water has a motion of descent; the air a motion of ascent; and therefore none of them can have any circular motion natural unto them.

I answer: first, these right motions of elementary bodies belong only to the parts of them, and that too when they are out of their proper places; so that the whole to which they belong, may notwithstanding this, have another mo-

* Lib. 1 sect. 1. cap. 5. † Syst. Mundi, Colloq. 2.

tion of its own. But secondly, this saying which Aristotle calls a principle, will not consist with other evident experiments of nature. Thus, though a loadstone, in respect of its matter and condensity, naturally tends downward; yet this does not hinder, but that in respect of some other qualities, as its desire of union and coition to another loadstone, it may also naturally move upwards. From whence it will follow, that the same elementary body may have divers natural motions.

5. The gravity and magnitude of this earthy globe do make it altogether unfit for so swift a motion.

I answer: first, heaviness can only be applied unto those bodies which are out of their proper places, or unto such parts as are severed from the whole to which they belong. And therefore the globe of earth, (considered as whole, and in its right place) cannot truly be called heavy. I deny not, but that there is in it, and so likewise in the other planets, an ineptitude to motion, by reason of the matter and condensity of their bodies; and so likewise there is as truly (though not according to the same degrees) in the least particle of a material condensed substance: so that this cannot reasonably be pretended as a just impediment, why the earth should be incapable of such a motion. Secondly, and though this globe be of so vast a magnitude, yet as nature bestows upon other creatures (for instance, an eagle and a fly) spirits, and motive powers, proportionable to their several bodies; so likewise may she endow the earth with a motive faculty answerable to its greatness. Or if this may make the earth incapable of so swift a motion as is supposed, much more then will the heavens be disabled for that greater swiftness which is imagined in them. I might add, the globe of the sun and Jupiter are observed to move about their own centres; and therefore the earth, which is far less than either of them, is not, by reason of its too great magnitude, made unfit for such a revolution. Thirdly: as for the swiftness of the earth's course, it does not exceed (all circumstances well considered) the celerity of some other motions, with which we are acquainted; as that of

the clouds, when driven by a tempestuous wind; that of a bullet shot from a cannon, which in the space of a minute does fly four miles*: or as another hath observed, in the second scruple of an hour it may pass the fifteenth part of a German mile. Than which, there is not any point in the earth's equinoctial that moves faster: and though a bullet be much slower in moving a greater distance, yet for so little a space, while the force of the powder is most fresh and powerful, it does equal the swiftness of the earth. And yet,

1. A bullet or cloud is carried in its whole body, being fain to break its way through the air round about it: but now the earth, (in respect of this first motion) does remain still in the same situation, and move only about its own centre.

2. The motion of a bullet is violent, and against its nature, which does strongly incline it to move downwards: whereas the earth, being considered as whole, and in its proper place, is not heavy, nor does it contain any repugnancy to a circular motion.

6. The chief argument on which our adversaries do most insist, is this. If there were such a motion of the earth as is supposed, then those bodies which are severed from it in the air, would be forsaken by it†. The clouds would seem to rise and set as the stars: the birds would be carried away from their nests: no heavy body could fall perpendicular: an arrow or bullet being shot from east to west by the same violence, will not be carried an equal distance from us, but we should by the revolution of our earth, overtake that which was shot to the east, before it could fall. If a man leaping up, should abide in the air but one second scruple of an hour, or the sixtieth part of a minute, the earth in that space would withdraw itself from him almost a quarter of a mile. All these, and many other such strange inferences, which are directly contrary to sense and experience, would follow from this motion of the earth.

* Meslin præfat. ad Narrat. Rhet. Fromond. Vesta. tract. 1. cap. 3.

† Arist. de Cælo, lib. 2. cap. 13.

There are three several ways most frequently used for the resolving of these kind of doubts.

1. From those magnetical qualities, which all elementary bodies do partake of.

2. From the like motion of other things, within the room of a sailing ship.

3. From the like participation of motion in the open parts of a ship.

1. For those magnetical properties, with which all these bodies are endowed. For the better understanding of this, you must know, that besides those common elementary qualities of heat, coldness, dryness, moisture, &c. which arise from the predominancy of several elements, there are likewise other qualities (not so well known to the ancients) which we call magnetical, of which every particle in the terrestrial globe does necessarily participate: and whether it be joined to this globe by continuity or contiguity, or whether it be severed from it, as the clouds in the second region, a bird, or bullet in the air; yet does it still retain its magnetical qualities, together with all those operations that proceed from them.

Now from these properties, do we suppose the circular motion of the earth to arise.

If you ask what probabilities there are, to prove that the earth is endowed with any such affections; I answer: it is likely, that the lower parts of this globe do not consist of such a soft fructifying earth, as there is in the surface, (because there can be no such use for it, as here, and nature does nothing in vain,) but rather of some hard rocky substance; since we may well conceive, that these lower parts are pressed close together by the weight of all those heavy bodies above them. Now it is probable, that this rocky substance is a loadstone, rather than a jaspis, adamant, marble, or any other; because experience teacheth us, that the earth and loadstone do agree together in so many properties. Suppose a man were to judge the matter of divers bodies, each of which should be wrapt up in some covering from his eye, so that he might only examine them by

some other outward signs: if in this examination he should find any particular body which had all the properties that are peculiar to a loadstone, he should in reason conclude it to be of that nature, rather than any other. Now there is altogether as much reason why we should infer, that the inward parts of the earth do consist of a magnetical substance. The agreement of these two you may see largely set forth in the treatise of D. Gilbert. I will instance only in one example; which of itself may sufficiently evidence, that the globe of earth does partake of the like affections with the loadstone. In the mariners needle you may observe the magnetical motions of direction, variation, declination; the two last of which are found to be different, according to the variety of places. Now this difference cannot proceed from the needle itself, because that is the same every where. Nor can we well conceive how it should be caused by the heavens; for then the variation would not be always alike in the same place, but diverse, according to those several parts of the heaven, which at several times should happen to be over it: and therefore it must necessarily proceed from the earth, which being itself endowed with magnetical affections, does diversly dispose the motions of the needle, according to the difference of that disponent virtue which is in its several parts.

Now to apply this unto the particular instances of the objection; we say, though some parts of this great magnet, the earth, may according to their matter be severed from the whole; yet are they always joined to it by a communion of the same magnetical qualities; and do no less observe these kind of motions, when they are separated from the whole, than if they were united to it. Nor need this seem incredible, that a heavy bullet, in such a swift violent course, should be able to observe this magnetical revolution of the whole earth; when as we see that those great bodies of Saturn, Jupiter, &c. hanging in the vast spaces of the æthereal air, do so constantly and regularly move on, in their appointed courses. Though we could not shew any simi-

of the ship; then may we easily conceive, that an arrow or bullet being shot with the same violence, will pass but the same space on the earth, whether or no it be shot towards the east or west.

If a heavy body, while the ship does move, will fall down in a strait line, then it is not the revolution of our earth that can hinder a perpendicular descent.

If a man leaping up in a ship, may abide in the air one second scruple of an hour, and yet this ship in its greatest swiftness not withdraw itself fifteen foot; then will not the earth in that space go from him almost a quarter of a mile.

But against this it is objected, that the earth has the similitude of an open ship, and not of any room that is close*. And though it be true, that when the roof and the walls do all move together, the air which is included betwixt them, must be carried along by the same motion; yet it is not so with the earth, because that hath not any such walls or roof, wherein it may contain and carry along with it the medium. And therefore experience will rather argue against this supposed revolution. Thus it is observed, that a stone being let fall from the mast of a ship that moves swiftly, will not descend to the same point, as if the ship did stand still. From whence it will follow, that if our earth had such a circular motion, then any heavy body being let fall from some high tower, or other steep place, would not descend unto that point of earth which was directly under it at the beginning.

To this we answer; that the air which moves along with our earth, is as well limited in certain bounds, as that which is included in a room. If you ask where these bounds are terminated; I answer, neither by the utmost parts of the world, nor yet by the concavity of the moon's orb (as Fromondus would have us affirm;) but by the sphere of vaporous air that encompasses our earth; or which is all one, by the orb of magnetical vigour, which proceeds from it. And besides, it is considerable that all earthly bodies are

* Fromondus. Vest. Tract. 2. cap. 2.

not only contained within these limits, as things are in a close room, but also as parts in that whole to which they belong.

2. Though the carrying along of the medium may solve the motion of light bodies in a ship, as the flame of a candle, smoke, or the like; yet this cannot concur to that which hath been said of heavy bodies, as a man leaping up, a bullet descending, &c. since it is not the motion of the mere air that is able to make these partake of the same motion with the ship. Unto that argument which he urges from the experiment of a stone falling in an open ship, we answer:

1. Though the instance of a ship may serve as a proof for this opinion, it being an argument *a minori ad majus*, from an accidental motion to a natural; yet it will not serve against it. For though it were not thus in accidental motions; yet this would not hinder but that it might be so in those that are supposed to be proper and natural.

2. As for that experiment itself, it is but a groundless imagination, and was never yet confirmed by any particular experience; because it is certain the event would be clean otherwise, as shall be proved in the third way of answering.

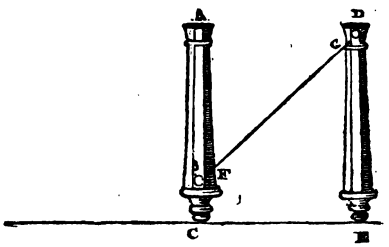
3. The third and last way of clearing the doubts in the sixth argument, is by shewing the like participation of motion, in those things that are in the open parts of a ship. To which purpose Galilæus* urges this experiment: If any one should let fall a stone from an high mast, he would find *lapidem in eundem semper navis locum decidere, seu consistat illa, seu quantacunque velocitate moveatur:* that the stone would always descend unto the very same place, whether or no the ship did move or stand still. The reason of which is, because the motion of the ship is likewise impressed in the stone: which impression is not equally prevalent in a light body, as a feather, or wool; because the air which has power over them, is not carried along by

* Syst. Mund. Colloq. 2.

the same motion of the ship. Thus likewise will it be in this other experiment: if a man upon a running horse should in his swiftest course let fall a bullet or stone, these heavy bodies, besides their own descent, would also participate that transverse motion of the horse. For as those things that are thrown from us, do continue their motion when they are out of the hand in the open air; so likewise must it be when the force is conferred by that motion which the arm has from the horse. While a man is riding, his arm is also carried by the same swiftness of the horse; therefore, if he should only open his hand and let fall any thing, it would not descend in a strait line, but must necessarily be driven forward, by reason of that force impressed in it by the swiftness of the horse, which is also communicated to the arm; it being all one in effect, whether or no the arm be moved by a particular motion of its own, as it is in casting of things from us; or by the common motion of the body, as it is in dropping of any thing from us, either when we are on the top of some sailing ship, as in the former; or on some running horse, as in this latter instance.

What hath been said concerning the motion of descents is likewise appliable, both to that which is upward, and that which is transversal. So that when it is objected, if the earth did move, then a bullet that were shot up perpendicularly would be forsaken by it, and not descend to the place from whence it arose: we answer, that the cannon which is upon the earth, together with the bullet in it, do partake of the same circular motion with the earth; and this perhaps our adversaries will grant, whilst we suppose the bullet to remain still in the cannon; all the difficulty will be to shew how it must necessarily observe the same motion, when it is shot out into the open air*. For the better explication of this, you may note this following figure.

* Gall. Syst. Colloq. 2.



Where we suppose A C to be a cannon perpendicularly, erected with a bullet in it at B, which if it were immoveable, we grant that the bullet being discharged, must ascend in a just perpendicular. But now conceive this cannon to move along with the earth, then in that space of time while the bullet by the force of the powder is ascending to the top of the bore, the cannon will be transferred to the situation D E; so that the bullet must be moved according to the line F G, which is not directly upright, but somewhat declining. Now the motion of the bullet in the air, must necessarily be conformed unto that direction that is impressed in it by the cannon from whence it is shot, and so consequently it must be continued according to the line F G, and therefore will always keep perpendicularly over the point from which it did ascend.

If you reply, that the motion of the bullet in the cannon must needs be so swift, that the earth cannot carry the cannon from C to E, in the same space of time wherein the bullet does move from B to A. I answer; it is not material whether the earth be of a greater or lesser swiftness than the bullet, because the declination must always be proportionable to the motion of the earth; and if we suppose this to be slower than the bullet, then the declination of the line F G, will be so much the less.

This truth may yet farther be illustrated by the practice of those fowlers, who used to kill birds as they are flying:

concerning which art, it is commonly thought that these men direct their aims to some certain space in the air, just before the birds, where they conceive the bullet will meet with them in their flight; whereas the truth is, they proceed in this case, the very same way, as if the birds did stand still, by a direct aiming at their bodies, and following of their flight by the motion of the piece, till at length, having got a perfect aim, they discharge, and do hit altogether as surely, as if the birds were sitting upon a tree. From whence we may observe, that the motion of the piece, as in our aiming it is made to follow the birds in their flight (though it be but slow,) yet is communicated to the bullet in the air.

But here it may seem very difficult to give any reason according to those grounds concerning the flight of birds; which being animated, have a liberty to fly here or there, to tarry for a good space of time in the open air, and so it is not easy to conceive what means there is, by which they should participate of the earth's diurnal revolution.

To this Galilæus answers, that the motion of the air, as it does turn about the clouds, so doth it also carry with it the birds, together with such other like things that are in it. For if some violent wind be able to drive with such swiftness a full laden ship, to throw down towers, to turn up trees, and the like; much more then may the diurnal motion of the air, (which does so far exceed in swiftness the most tempestuous wind) be able to carry with it the bodies of birds.

But if all things be turned about by this revolution, then it should seem there is no such thing as a right motion, whether of ascent, or descent in a strait line.

I answer; the moving of heavy or light bodies, may be considered in a double relation.

1. According to the space wherein they move, and we grant their motions not to be simple, but mixed of a direct and circular.

2. According to the body or medium wherein they move, and then they may properly be said to have right

motions, because they pass through the medium in a strait line; and therefore it is, that unto us they seem directly to ascend or descend. Aristotle himself would not deny, but that fire may ascend in a strait line unto its sphere; and yet participate also of that circular motion which he supposes to be communicated from the heaven, unto the upper part of the air, and its own region. So likewise must it be for the descent of any thing. Suppose a ship in its swiftest motion, and a man in it, having some vessel filled with water, should let fall into it a little ball of wax, or some other matter which may be slow in its sinking, so that in one minute it should scarce descend the space of a cubit, though the ship (it may be) in the same time may pass at least a hundred cubits; yet would this still seem unto the eye to descend in a strait line; and the other motion which is communicated unto it by the ship, would not at all be discernible in it. And though in this case, the motion were in itself composed of a circular and direct; yet in respect of us it would appear, and so might be stiled, exactly strait.

Now if it be thus in those which are generally granted to be preternatural motions; we need not doubt then the possibility of the like effect in that motion which we conceive to be proper and natural, both to the earth, and the things that belong unto it.

There is yet another objection to this purpose urged by Malapertius*, a late jesuit; who, though he do with much eagerness press this argument concerning a bullet or stone, against the opinion of Copernicus; yet he grants that it might easily be resolved, if the defenders of it would affirm that the air did move round with the earth. But this, says he, they dare not avouch; for then the comets would always seem to stand still, being carried about with the revolution of this air; and then they could not rise or set, as experience shews they do.

To this it may be answered, that most comets are above

* Austriaca Syder. par. 2. prop. 25.

that sphere of air which is turned round with our earth, as is manifest by their height. The motion that appears in them, is caused by the revolution of our earth, whereby we are turned from them.

As for those which are within the orb of our air, these do seem to stand still. Such a one was that mentioned by Josephus*, which did constantly hang over Jerusalem; and that likewise which appeared about the time of Agrippa's death, and for many days together did hang over the city of Rome. Wherefore Seneca† does well distinguish out of Epigenes, betwixt two sorts of comets; the one being low, and such as seem immoveable; the other higher, and such as did constantly observe their risings and settings, as the stars.

I have done with all the arguments of any note or difficulty, that are urged against this diurnal motion of the earth. Many other cavils there are, not worth the naming, which discover themselves to be rather the objections of a captious, than a doubtful mind. Amongst which, I might justly pass over those that are set down by Alex. Rosse‡. But because this author does proceed in his whole discourse with so much scorn and triumph, it will not be amiss therefore to examine what infallible evidence there is in those arguments upon which he grounds his boastings.

We have in one chapter no less than these nine.

1. If the earth did move, then would it be hotter than the water, because motion does produce heat: and for this reason likewise, the water would be so hot and rarified, that it could not be congealed; since that also does partake of the same motion with the earth.

2. The air which is next the earth, would be purer, as being rarified with motion.

3. If the earth did move the air, it would cause some sound; but this is no more audible, than Pythagoras's harmony of the heavens.

* De bello Judaico, l. 7. cap. 12. Dion. l. 54.

† Nat. Qu. lib. 7. cap. 6. ‡ Lib. 1. sect. 2. cap. 6.

4. It would have been in vain for nature to have endowed the heavens with all conditions requisite for motion, if they had been to stand still. As first, they have a round figure. Secondly, they have neither gravity nor levity. Thirdly, they are incorruptible. Fourthly, they have no contrary.

5. All similary parts are of the same nature with the whole: but each part of the earth does rest in its place; therefore also doth the whole.

6. The sun in the world is as the heart in a man's body; but the motion of the heart ceasing, none of the members do stir: therefore also if the sun should stand still, the other parts of the world would be without motion.

7. The sun and heavens do work upon these inferior bodies by their light and motion. So the moon does operate upon the sea.

8. The earth is the foundation of buildings, and therefore must be firm and stable.

9. It is the constant opinion of divines, that the heavens shall rest after the day of judgment; which they prove from Isa. vi. 20. Thy sun shall no more go down, neither shall thy moon withdraw itself. So likewise, Rev. x. 6. The angel swears that there shall be time no longer; and therefore the heavens must rest, since by their motion it is that time is measured. And St. Paul says, Rom. viii. 20. That all the creatures are subject to vanity. Now this can be no other in the heavens, than the vanity of motion, which the wise man speaks of, Eccles. i. 4. The sun riseth, and the sun goeth down, &c.

To these it may be answered:

In the first you may note a manifest contradiction, when he will have the earth to be hotter than the water, by reason of this motion; when as notwithstanding, he acknowledges the water to move along with it: and therefore too in the next line, he infers that the water, because of that heat and rarefaction which it receives from this motion with the earth, must be incapable of so much cold, as to be congealed into ice.

But unto that which may be conceived to be his meaning in this and the next argument; I answer: if he had fully understood this opinion which he opposes, he would easily have apprehended that it could not be prejudiced by either of these consequences. For we suppose that not only this globe of earth and water, but also all the vaporous air which environs it, are carried along by the same motion. And therefore, though what he says concerning the heat; which would be produced by such a motion, were true, yet it would not be pertinent, since our earth and water, and the air next unto them, are not by this means severed from one another, and so do not come within the compass of this argument.

If any reply, that this will notwithstanding hold true concerning the upper part of the air, where there is such a separation of one body from another; and so consequently, an answerable heat. I answer,

1. It is not generally granted, that motion in all kind of bodies does produce heat; some restrain it only to solid bodies, affirming, that in those which are fluid, it is rather the cause of coldness. This is the reason, say they, why running waters are ever to our sense the coolest; and why, amongst those winds which proceed from the same coasts of heaven, about the same time of the year, the strongest always is the coldest? If you object, that running waters are not so soon frozen as others, they answer; this is not because they are thereby heated, but because unto congelation it is requisite that a body should settle and rest, as well as be cold.

2. If we should grant a moderate heat in those parts of the air, we have not any experiment to the contrary, nor would it prejudice the present opinion, or common principles.

As the sound of this motion is not more heard than the harmony of the heavens; so neither is there any reason why this motion should cause a sound, more than the supposed motion of the heavens, which is likewise thought to be continued unto the air hard by us.

This will prove the earth to move as well as the heavens: for that has, first, a round figure, as is generally granted. Secondly, being considered as whole, and in its proper place, it is not heavy, as was proved before. And as for the two other conditions, neither are they true of the heavens, nor if they were, would they at all conduce to their motion.

1. This argument would prove that the sea did not ebb and flow, because there is not the same kind of motion in every drop of water; or that the whole earth is not spherical, because every little piece of it is not of the same form.

This is rather an illustration than a proof; or if it do prove any thing, it may serve as well for that purpose unto which it is afterward applied, where the motion of every planet is supposed to depend upon the revolution of the sun.

That the sun and planets do work upon the earth by their own real daily motion, is the thing in question; and therefore must not be taken for a common ground.

We grant that the earth is firm and stable from all such motions whereby it is joggled or uncertainly shaken.

1. For the authority of those divines, which he urges for the interpretation of these scriptures; this will be but a weak argument against that opinion which is already granted to be a paradox.

2. The scriptures themselves, in their right meaning, will not at all conduce to the present purpose.

As for that in Isaiah, if we consult the coherence, we shall find that the scope of the prophet is to set forth the glory of the church triumphant. Wherein he says there shall not be any need of the sun or moon, but God's presence shall supply them both: for the Lord shall be unto thee an everlasting light, and thy God thy glory, ver. 19. and as for this sun and moon, it shall not go down, or withdraw itself, but he shall be an everlasting light without intermission. So that it is evident he speaks of

that light which shall hereafter be instead of the sun and moon*.

As for that in the Revelations, we yield that time shall cease; but to say that this depends upon the cessation of the heavens, is to beg the question, and to suppose that which is to be proved; viz. that time is measured by the motion of the heavens, and not of the earth. Perrerius† (from whom this last argument was borrowed without acknowledgment) might have told him in the very same place, that time does not absolutely and universally depend upon the motion of the heavens, *sed in motu et successione, cujuslibet durationis*, but in any such succession, by which duration may be measured.

As for that in the Romans, we say, that there are other vanities to which the heavenly bodies are subject: as first, unto many changes and alterations; witness those comets which at several times have been discerned amongst them; and then likewise to that general corruption, in which all the creatures shall be involved at the last day. When they shall pass away with a great noise, and the elements shall melt with fervent heat‡.

Thus you see, there is not any such invincible strength in these arguments, as might cause the author of them to triumph before-hand with any great noise of victory.

Another objection like unto these is taken from the etymology of several words. Thus the heavens are called *Æthera, ab* ἀεὶ θεῖν, because they are always in motion, and the earth *Vesta, qui vi stat*, because of its immobility.

To which I answer; it were no difficult matter to find such proofs for this opinion, as well as against it.

Thus we may say that the Hebrew word אֶרֶץ is derived from רוּץ *quia currit*; and *terra, non quod terratur, sed quod perenni cursu omnia terat*, saith Calcagnius. However, though we suppose the etymology to be never so true and

* Vid. Revel. xxi. 23. item xxii. 5.

† Gen. c. 1. l. 2. quæst. 6.

‡ 2 Pet. iii. 10, 12.

genuine, yet it can at the best but shew what the more common opinion was of those times when such names were first imposed.

But suppose all this were so, that the earth had such a diurnal revolution; yet how is it conceivable that it should at the same time have two distinct motions?

I answer: this may easily be apprehended, if you consider how both these motions do tend the same way from west to east. Thus a bowl being turned out of the hand, has two motions in the air; one, whereby it is carried round; the other, whereby it is cast forward.

From what hath been delivered in this chapter, the indifferent reader may gather some satisfaction for those arguments which are usually urged against this diurnal motion of the earth.

PROP. IX.

That it is more probable the earth does move, than the sun or heavens.

AMONGST those many arguments that may be urged for the confirmation of this truth, I shall set down only these five.

1. If we suppose the earth to be the cause of this motion, then will those vast and glorious bodies of the heavens be freed from that inconceivable, unnatural swiftness, which must otherwise be attributed unto them.

For if the diurnal revolution be in the heavens, then it will follow according to the common hypothesis*, that each star in the equator must in every hour move at the least 4529538 German miles. So that according to the observation of Cardan†, who tells us that the pulse of a

* Vid. Mesl. Epit. Astr. l. 1. in fine.

† De Prop. l. 5. prop. 58.

well-tempered man does beat 4000 times in an hour, one of these stars in that space, whilst the pulse beats once, must pass 1132 German miles (saith Alphraganus:) or according to Tycho, 732 German miles. But these numbers seem to be somewhat of the least, and therefore many others do much enlarge them, affirming that every star in the equator, in one beating of the pulse, must move 2528 of these miles.

It is the assertion of Clavius *, that though the distance of the orbs, and so consequently their swiftness, seem to be altogether incredible; yet it is rather far greater in itself than astronomers usually suppose it; and yet saith he, according to the common grounds, every star in the equator must move 42398437½ miles in an hour. And though a man should constantly travel forty miles a day, yet he would not be able to go so far as a star does in one hour, under 2904 years: or if we will suppose an arrow to be of the same swiftness, then must it compass this great globe of earth and water 1884 times in an hour. And a bird that could but fly as fast, might go round the world seven times in that space, whilst one could say, *Ave Maria, gratia plena, Dominus tecum.*

Which though it be a pretty round pace, yet you must conceive that all this is spoken only of the eighth sphere; and so being compared to the swiftness of the *primum mobile*, is but a slow and heavy motion.

For (saith the same author) the thickness of each orb is equal to the distance of its concave superficies from the centre of the earth. Thus the orb of the moon does contain as much space in its thickness, as there is betwixt the nearest parts of that and the centre. Thus also the eighth sphere is as thick as that whole space betwixt the centre of the earth and its own concave superficies. So likewise must it be in those three other orbs, which he supposes to be above the starry heaven. Now if we proportion their swiftness according to this difference in their

* Comment. in prim. cap. Sphæra.

bigness, you may then conceive (if you can) what a kind of celerity that must be, by which the *primum mobile* will be whirled about.

Tycho makes the distance of the stars to be much less, and their motion slower; and yet he is fain to confess, that it is *omni cogitatione celerior.*

Clavius likewise speaking concerning the swiftness of the starry orb, does acknowledge, *Quod velocitas ejus captum humani ingenii excedit.* What then could he think of the *primum mobile?*

Dr. Gilbert * being it seems astonished at the consideration of this strange swiftness, says of it, that it is *motus supra omnes cogitationes, somnia, fabulas & licentias poeticas insuperabilis, ineffabilis, incomprehensibilis.* A man may more easily conceive the possibility of any fable or fiction, how beasts and trees might talk together, than how any material body should be moved with such a swiftness.

Not but that it is possible for God to turn them about with a far greater velocity. Nay it is possible for art to contrive a motion, which shall be equally slow in that proportion as this is swift. But however, the question here is not what can be done, but what is most likely to be done according to the usual course of nature. It is the part of a philosopher, in the revolution of natural events, not to fly unto the absolute power of God, and tell us what he can do, but what according to the usual way of providence is most likely to be done, to find out such causes of things, as may seem most easy and probable to our reason.

If you ask what repugnancy there is in the heavens, unto so great a swiftness: we answer, their being such vast material condensed substances, with which this inconceivable motion cannot agree.

Since motion and magnitude are two such geometrical things, as bear a mutual proportion to one another; therefore it may seem convenient, that slowness should be more agreeable to a great body, and swiftness to a lesser: and so it should be more consonant to the principles of nature, that

* De magnete, l. 6. c. 3.

the earth, which is of a lesser quantity, should be appointed to such a motion as is somewhat proportionable to its bigness, than that the heavens that are of such a vast magnitude, should be whirled about with such an incredible swiftness, which does as far exceed the proportion of their bigness, as their bigness does exceed this earth, that is but a point or centre to them. It is not likely that nature in these constant and great works, should so much deviate from that usual harmony and proportion which she observes in lesser matters. If this globe of earth only were appointed to move every day round the orb of the fixed stars, though it be but a little body, and so more capable of a swift motion; yet that swiftness would be so extremely disproportionable unto it, that we could not with reason conceive it possible, according to the usual course of nature. But now that the heavens themselves, of such strange bigness, with so many stars, which do so far exceed the magnitude of our earth, should be able to turn about with the same celerity, oh! it is altogether beyond the fancy of a poet or a madman.

For answer unto this argument, our adversaries tell us: that there is not in the heavens any repugnancy to so swift a motion; and that whether we consider the nature of those bodies; or, secondly, the swiftness of this motion.

I. For the nature of those bodies, either their { Qualities. / Quantity.

1. There is not in them the qualities of lightness or heaviness, or any the least contrariety that may make them reluctant to one another.

2. Their magnitude will help them in their swiftness *: for the greater any body is, the quicker will it be in its motion, and that not only when it is moved by an inward principle, as a millstone will descend faster than a little pebble; but also when its motion does proceed from some external agent; as the wind will drive a great cloud, or a heavy ship, when it is not able to stir a little stone.

* Ross. l. 1. sect. 1. c. 1.

II. As for the swiftness of this motion, the possibility of it may be illustrated by other particulars in nature: as,

1. The sound of a cannon, in a little time is carried for twenty miles distance *.

2. Though a star be situated so remotely from us, yet the eye discerns it in a moment, which is not without some motion, either of the species of the star, or the rays of the eye. Thus also the light does in an instant pass from one side of the heaven to another †.

I. If the force of powder be able to carry a bullet with so great a swiftness, we need not doubt then, but that the heavens are capable of such a celerity as is usually attributed unto them.

Unto these it may be answered:

1. Where they say that the heavenly bodies are without all gravity, we grant it, in the same sense as our earth also, being considered as whole, and in its proper place, may be denied to be heavy: Since this quality in the exactest sense, can only be ascribed unto such parts as are severed from the whole to which they belong. But however, since the heavens or stars are of a material substance, it is impossible but there should be in them some ineptitude to motion; because matter is of itself a dull and sluggish thing; and by so much the more, as it is kept close and condensed together. And though the followers of Ptolemy do with much confidence deny the heavens to be capable of any reluctancy to motion, yet it were easy to prove the contrary out of their own principles. It is not conceivable how the upper sphere should move the nether, unless their superficies were full of rugged parts (which they deny): or else one of the orbs must lean upon the other with its weight, and so make it partake of its own motion. And besides, they tell us, that the farther any sphere is distant from the *primum mobile*, the less it is hindered by that in its proper course, and the sooner does it finish its own revolution.

* Ross, l. 2. sect. 1. c. 5. † Idem, l. 1. sect. 1. c. 2.

From whence it will easily follow, that these bodies have resistency from one another.

I have often wondered why amongst the enchanted buildings of the poets, they have not feigned any castle to be made of the same materials with the solid orbs, since in such a fabric there would have been these eminent conveniences.

1. It must needs be very pleasant, by reason of its perspicuity, because it is more diaphanous than the air itself, and so the walls of it could not hinder the prospect any way.

2. Being so solid and impenetrable, it must needs be excellent against all violence of weathers, as also against the assaults of the enemy, who should not be able to break it with the most furious batteries of the ram, or pierce it with any cannon shot.

3. Being void of all heaviness, a man may carry it up and down with him, as a snail does his house; and so whether he follow the enemy, or fly from him, he has still this advantage, that he may take his castle and defence along with him.

But then again, there are on the other side as many inconveniencies. For,

1. Its perspicuity would make it so open, that a man should not be able to retire himself into any private part of it. And then,

2. Being so extremely solid, as well as invisible, a man should be still in danger of knocking his head against every wall and pillar; unless it were also intangible, as some of the peripatetics affirm.

3. Its being without all gravity, would bring this inconvenience, that every little puff of wind would blow it up and down; since some of the same sect are not ashamed to say, that the heavens are so utterly devoid of heaviness, that if but a little fly should jostle against the vast frame of the celestial spheres, he would move them out of their places.

A strong fancy, that could be at leisure, might make excellent sport with this astronomical fiction.

So that this first evasion of our adversaries will not shelter them from the force of that argument, which is taken from the incredible swiftness of the heavens.

2. Whereas they tell us in the second place, that a bigger body, as a millstone, will naturally descend swifter than a less, as a pebble. I answer: this is not because such a great body is in itself more easily moveable, but because the bigger any thing is which is out of its own place, the stronger will be its natural desire of returning thither, and so consequently, the quicker its motion. But now those bodies that move circularly, are always in their proper situations, and so the same reason is not appliable unto them. And then, whereas it is said, that magnitude does always add to the swiftness of a violent motion (as wind will move a great ship sooner than a little stone: we answer: this is not because a ship is more easily moveable in itself than a little stone: for I suppose the objector will not think he can throw the one as far as the other; but because these little bodies are not so liable to that kind of violence from whence their motion does proceed.

As for those instances, which are cited to illustrate the possibility of this swiftness in the heavens, we answer: the passage of a sound is but very slow in comparison to the motion of the heavens. And then besides, the swiftness of the species of sound or sight which are accidents, are not fit to infer the like celerity in a material substance: and so likewise for the light which Aristotle himself *, and with him the generality of philosophers, do for this very reason prove not to be a body, because it moves with such swiftness, of which (it seems) they thought a body to be incapable. Nay, the objector † himself in another place, speaking of light in reference to a substance, does say: *Lumen est accidens, sic species rei visæ, & alia est ratio substantiarum, alia accidentium.*

To that of a bullet, we answer: he might as well have illustrated the swiftness of a bullet, which will pass four or five miles in two minutes, by the motion of a hand in a

* De Anima, l. 2. c. 7. † Ross. l. 2. sect. 1. c. 4.

watch, which passes two or three inches in twelve houts; there being a greater disproportion betwixt the motion of the heavens and the swiftness of a bullet, than there is betwixt the swiftness of a bullet and the motion of a hand in a watch.

Another argument to this purpose may be taken from the chief end of the diurnal and annual motions, which is to distinguish betwixt night and day, winter and summer; and so consequently, to serve for the commodities and seasons of the habitable world. Wherefore it may seem more agreeable to the wisdom of providence, for to make the earth as well the efficient, as the final cause of this motion; especially since nature in her other operations does never use any tedious difficult means to perform that which may as well be accomplished by shorter and easier ways. But now, the appearances would be the same, in respect of us, if only this little point of earth were made the subject of these motions, as if the vast frame of the world, with all those stars of such number and bigness were moved about it. It is a common maxim, Μηδεν εικη την Φυσιν εργαζεσθαι *. Nature does nothing in vain, but in all her courses does take the most compendious way. It is not therefore (I say) likely, that the whole fabric of the heavens, which do so much exceed our earth in magnitude and perfection, should be put to undergo so great and constant a work in the service of our earth, which might more easily save all that labour by the circumvolution of its own body; especially, since the heavens do not by this motion attain any farther perfection for themselves, but are made thus serviceable to this little ball of earth. So that in this case it may seem to argue as much improvidence in nature to employ them in this motion, as it would in a mother †, who in warming her child, would rather turn the fire about that, than that about the fire: or in a cook ‡, who would not roast his meat by turning it about to the fire; but rather, by turning the fire about it: or in a man ‖, who ascending some high tower, to

* Galen. † Lansberg. ‡ Keplar. ‖ Galil.

save the labour of stirring his head, should rather desire that all the regions might successively be turned before his eye, that so he might easily take a view of them.

We allow every watchmaker so much wisdom as not to put any motion in his instrument, which is superfluous, or may be supplied an easier way: and shall we not think that nature has as much providence as every ordinary mechanic? or can we imagine that she should appoint those numerous and vast bodies, the stars, to compass us with such a swift and restless motion, so full of confusion and uncertainties, when as all this might as well be done by the revolution of this little ball of earth?

Amongst the several parts of the world, there are six planets which are generally granted to move. As for the sun and the earth, and the fixed stars, it is yet in question, which of them are naturally endowed with the same condition. Now common reason will dictate unto us, that motion is most agreeable to that which in kind and properties is most near to those bodies that undoubtedly are moved. But now there is one eminent qualification, wherein the earth does agree with the planets; whereas the sun, together with the fixed stars, do in the same respect differ from them: and that is light, which all the planets, and so too the earth, are fain to borrow elsewhere, whilst the sun and the stars have it of their own. From whence it may be probably concluded, that the earth is rather the subject of this motion than the other. To this it may be added, that the sun and stars seem to be of a more excellent nature than the other parts of the world; and therefore should in reason be endowed with the best qualifications. But now motion is not so noble a condition as rest. That is but a kind of wearisome and servile thing; whereas, this is usually ascribed to God himself: of whom it is said:

Immotus stabilisque manens dans cuncta moveri *.

Aristotle † tells us, it is very agreeable to reason that the time appointed for the revolution of each orb should

* Boet. de Consol. Phil. l. 3. † De Cœlo, l. 2. c. 10.

be proportionable to its bigness. But now this can only be by making the earth a planet, and the subject of the annual and diurnal motions. Wherefore it is probable, that this does rather move than the heavens.

According to the common hypothesis, the *primum mobile* will move round in a day. Saturn in thirty years. Jupiter in twelve. Mars in two. The Sun, Venus, and Mercury, which have several orbs, yet will agree in their revolutions, being each of them about a year in finishing their courses: whereas by making the earth a planet, there will be a just proportion betwixt the bigness of the orbs and the time of their motions: for then, next to the sun or centre, there will be the sphere of Mercury; which as it is but narrower in its diameter, so likewise is it quick in its motion, running its course in 88 days. Venus, that is next unto it, in 224 days. The earth in 365 days, or a year. Mars in 687 days, Jupiter in 4332 days, Saturn in 10759 days. Thus likewise is it with those Medicean stars that encompass Jupiter. That which is lowest amongst them, finishes his course in two and twenty hours; the next in three days and a half; the third in seven days; and the farthest in seventeen days. Now as it is (according to Aristotle's confession) more likely that nature should observe such a due proportion betwixt the heavenly orbs; so is it more probable, that the earth should move, rather than the heavens.

This may likewise be confirmed from the appearance of comets: concerning which there are three things commonly granted, or if they were not, might be easily proved: namely,

1. That there are divers comets in the air, betwixt the moon and our earth.

2. That many of these comets do seem to rise and set as the stars.

3. That this appearing motion is not properly their own, but communicated unto them from somewhat else.

But now, this motion of theirs cannot be caused by the

heavens; and therefore it must necessarily proceed from the revolution of our earth.

That the moon's orb cannot carry along with it the greater part of the air, wherein these comets are placed, might easily be proved from the common grounds. For the concave superficies of that sphere is usually supposed to be exactly terse and smooth; so that the meer touch of it cannot turn about the whole element of fire, with a motion that is not natural unto it. Nor could this elementary fire, which they imagine to be of a more rarified and subtle nature, communicate the same motion to the thicker air, and that to the waters (as some affirm:) for by what means could that smooth orb take hold of the adjoining air? To this Sarsius answers, that there are great gibbosities and mountainous inequalities in the concavity of the lowest sphere, and by these is it enabled to carry along with it the fire and air. But Fromondus * tells him, *Fictitia ista & ad fugam reperta sunt.* And yet his own conjecture is scarce so good, when he affirms, that this motion of the æthereal air, as also of that elementary air hard by us, is caused by that ruggedness which there is in the bodies of the planets; of which opinion we may with as good reason say as he says to Sarsius, *fictitia ista & ad fugam reperta:* these things are meer fictions invented for shifts, and without any probable ground.

But now this appearance of the comets may easily be resolved, if we suppose the earth to move. For then, though they did still remain in their wonted places; yet this, by its diurnal revolution successively withdrawing itself from them, they will appear to rise and set. And therefore, according to this common natural experiment, it is more probable that the earth should move, than the heavens.

Another argument urged by some to prove that this globe of earth is easily moveable, is taken from the opinion of those who affirm that the access of any weight unto a

* Antar. cap. 16.

new place *, as suppose an army, does make the earth poise itself afresh, and change the centre of gravity that it had before: but this is not generally granted; and therefore not to be insisted on as a common ground.

To this purpose likewise is that inference of Lansbergius, who from Archimedes his saying, that he could move the earth, if he knew where to stand and fasten his instrument; concludes, that the earth is easily moveable; whereas it was the intent of Archimedes in that speech, to shew the infinite power of engines: there being no weight so great, but that an instrument might be invented to move it.

Before we finish this chapter, it is requisite that we inquire what kind of faculty that is from which these motions that Copernicus ascribes unto the earth, do proceed: whether or no it be some animal power, that does assist (as Aristotle) or inform (as Keplar thinks,) or else some other natural motive quality which is intrinsical unto it.

We may observe, that when the proper genuine cause of any motion is not obvious, men are very prone to attribute unto that which they discern to be the most frequent original of it in other things, life. Thus the stoics affirm the soul of the water to be the cause of the ebbing and flowing of the sea. Thus others think the wind to proceed from the life of the air, whereby it is able to move itself several ways, as other living creatures †. And upon the same grounds do the Platonics, Stoics, and some of the Peripatetics, affirm the heavens to be animated. From hence likewise it is, that so many do maintain Aristotle his opinion concerning intelligences; which some of his followers, the schoolmen, do confirm out of scripture, from that place in Matthew xxiv. 29. where it is said, the powers of the heavens shall be shaken. In which words, by powers (say they) are meant the angels, by whose power it is, that the heavens are moved. And so likewise in that, Job ix. 13. where the vulgar has it, *sub quo curvantur, qui portant orbem*; that is,

* Vid. Vasq. l. 1. diff. 2. cap. 8. 16.

† Sen. Nat. Quest. l. 5. cap. 5, 6.

the intelligences. Which text might serve altogether as well, to prove the fable of Atlas and Hercules. Thus Cajetan concludes from that place in the Psalm cxxxvi. 5. where it is said, "God by wisdom made the heavens; or according to the vulgar, *Qui fecit cælos intellectu*, that the heavens are moved by an intelligent soul.

If we consider the original of this opinion, we shall find it to proceed from that mistake of Aristotle, who thought the heavens to be eternal; and therefore to require such a moving cause, as being of an immaterial substance, might be exempted from all that weariness and inconstancy which other things are liable unto.

But now this ground of his is evidently false, since it is certain that the heavens had a beginning, and shall have an end. However, the employing of angels in these motions of the world, is both superfluous, and very improbable.

1. Because a natural power, intrinsical to those bodies, will serve the turn as well. And as for other operations, which are to be constant and regular, nature does commonly make use of some inward principle.

2. The intelligences being immaterial, cannot immediately work upon a body; nor does any one tell us what instruments they should make use of in this business. They have not any hands to take hold of the heavens, or turn them about. And that opinion of Aquinas, Durand, Soncinus, with other schoolmen, seems to be without all reason; who make the faculty whereby the angels move the orbs, to be the very same with their understandings and will: so that if an angel do but merely suspend the act of willing their motion, they must necessarily stand still: and on the contrary, his only willing them to move, shall be enough to carry them about in their several courses: since it were then a needless thing for providence to have appointed angels unto this business, which might have been done as well by the only will of God. And besides, how are the orbs capable of perceiving this will in the intelligences? Or if they were, yet what motive faculty have they of themselves, which can enable them to obey it?

Now as it would be with the heavens, so likewise is it with the earth, which may be turned about in its diurnal revolution, without the help of intelligences, by some motive power of its own, that may be intrinsical unto it.

If it be yet inquired, what cause there is of its annual motion: I answer; it is easily conceivable, how the same principle may serve for both these, since they tend the same way from west to east.

However, that opinion of Keplar is not very improbable, that all the primary planets are moved round by the sun, which once in twenty-five or twenty-six days, does observe a revolution about its own axis, and so carry along the planets that encompass it; which planets are therefore slower or swifter, according to their distances from him. If you ask by what means the sun can produce such a motion? he answers; by sending forth a kind of magnetic virtue in strait lines, from each part of its body; of which there is always a constant succession: so that as soon as one beam of this vigour has passed a planet, there is another presently takes hold of it, like the teeth of a wheel.

But how can any virtue hold out to such a distance?

He answers: first, as light and heat, together with those other secret influences which work upon minerals in the bowels of the earth; so likewise may the sun send forth a magnetic, motive virtue, whose power may be continued to the farthest planets. Secondly, if the moon, according to common philosophy, may move the sea, why then may not the sun move this globe of earth?

In such queries as these, we can conclude only from conjectures: that speech of the wise man, Eccles. iii. 11. being more especially verified of astronomical questions concerning the frame of the whole universe, that no man can find out the works of God from the beginning to the end. Though we may discern divers things in the world, which may argue the infinite wisdom and power of the author, yet there will be always some particulars left for our dispute and inquiry, and we shall never be able with all our industry, to attain a perfect comprehension of the crea-

tures, or to find them wholly out, from the beginning to the end.

The providence of God having thus contrived it *, that so man might look for another life after this, when all his longing and thirst shall be fully satisfied. For since no natural appetite is in vain, it must necessarily follow, that there is a possibility of attaining so much knowledge as shall be commensurate unto these desires; which because it is not to be had in this world, it will behove us then to expect and provide for another.

PROP. X.

That this hypothesis is exactly agreeable to common appearances.

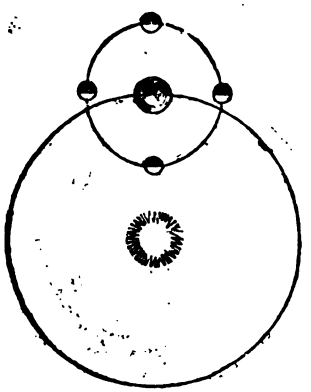
IT hath been already proved, that the earth is capable of such a situation and motion as this opinion supposes it to have. It remains, that in the last place we shew how agreeable this would be unto those ordinary seasons of days, months, years, and all other appearances in the heavens.

1. As for the difference betwixt days and nights; it is evident, that this may be as well caused by the revolution of the earth, as the motion of the sun; since the heavenly bodies must needs seem after the same manner to rise and set, whether or no they themselves by their own motion, do pass by our horizon and vertical point; or whether our horizon and vertical point, by the revolution of our earth, do pass by them. According to that of Aristotle †, ωδεν διαφερει κινειν την οψιν ἡ το ορωμενον, there will not appear any difference, whether or no the eye be moved from the object, or the object from the eye. And therefore I cannot chuse but wonder that a man of any reason or sense, should

* Valles. sacr. Philos. c. 64. † De Cœlo, lib. 2. cap. 8.

make choice of no better an argument to conclude his book withal, than that which we read at the latter end of Al. Rosse, where he infers, that the earth does not move, because then the shadow in a sun-dial would not be altered.

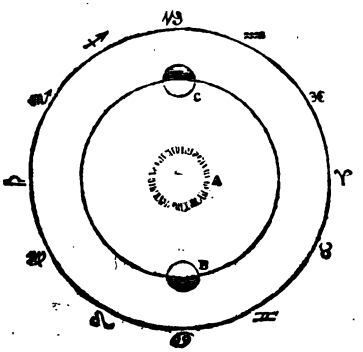
2. As for the difference of months, we say, that the diverse illumination of the moon, the different bigness of her body, her remaining for a longer or shorter time in the earth's shadow, when she is eclipsed, &c. may well enough be solved by supposing her to move above our earth, in an eccentrical epicycle. Thus,



In which kind of hypothesis, there will be a double difference of motion; the one caused by the different situations of the moon's body, in its own eccentric; the other by the different situations of the moon's orb, in the earth's eccentric: which is so exactly answerable to the motions and appearances of this planet, that from hence Lansbergius draws an argument for this system of the heavens, which in the strength of his confidence he calls, *demonstrationem* ἐκ στημονικην, *cui nulla ratione potest contradici.*

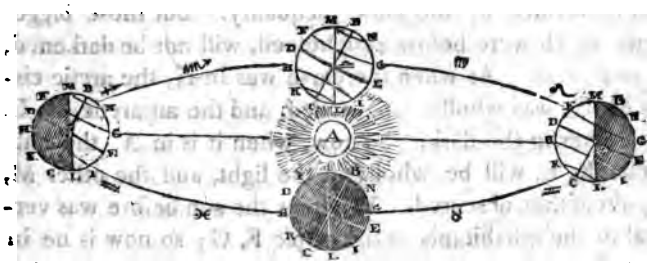
4. As for the difference betwixt winter and summer; betwixt the number and length of days, which appertain to each of those seasons; the seeming motion of the sun from one sign to another in the zodiac: all this may easily be

solved, by supposing the earth to move in an eccentrical orb about the sun. Thus,



Suppose the earth to be at C, then the sun at A will seem to be in the sign ♋, and at the greatest distance from us, because the earth is then in the farthest part of its eccentric. When after by its annual motion it hath passed successively by the signs ♎ ♐ ♑ ♒ ♓, at length it comes to the other solstice at B, where the sun will appear in ♑, and seem biggest, as being in its perige, because our earth is then in the nearest part of its eccentric.

As for all other appearances of the sun which concern the annual motion, you may see by the following figure, that they are exactly agreeable to this hypothesis.



Where you have the earth described about the sun at A, in the four chief points of the zodiac; namely, the two

equinoctials at ♈ and ♎, and the solstices at ♑ and ♋. Through all which points the earth does pass in his annual motion from west to east.

The axis upon which our earth does move, is represented by the line B C, which axis does always decline from that of the ecliptic, about 23 degrees, 30 minutes. The points B C are imagined to be the poles, B the north-pole, and C the south.

Now if we suppose this earth to turn about its own axis by a diurnal motion, then every point of it will describe a parallel circle, which will be either bigger or lesser, according to its distance from the poles. The chief of them are the equinoctial D, E. The two tropics, F, G; and H, I, the two polar circles. M, N, the arctic, and K, L, the antarctic; of which the equinoctial only is a great circle, and therefore will always be equally divided by the line of illumination M, L, whereas the other parallels are thereby distributed into unequal parts. Amongst which parts, the diurnal arches of those that are towards B, the north pole, are bigger than the nocturnal, when our earth is in ♑ and the sun appears in ♋: insomuch, that the whole arctic circle is enlightened, and there is day for half a year together under that pole.

Now when the earth proceeds to the other solstice at ♋, and the sun appears in ♑, then that hemisphere must be involved in darkness, which did before partake of light. And those parallels towards the north and south poles will still be divided by the same inequality. But those bigger parts which were before enlightened, will not be darkened, *et vice versa*. As when the earth was in N, the arctic circle M, N, was wholly enlightened, and the antarctic, K, L, altogether in the dark. So now, when it is in A, the antarctic K, L, will be wholly in the light, and the other M, N, altogether obscured. Whereas the sun before was vertical to the inhabitants at the tropic F, G; so now is he in the same situation to those that live under the other tropic H, I. And whereas before the pole did incline 23 degrees 30 minutes towards the sun, so now does it decline

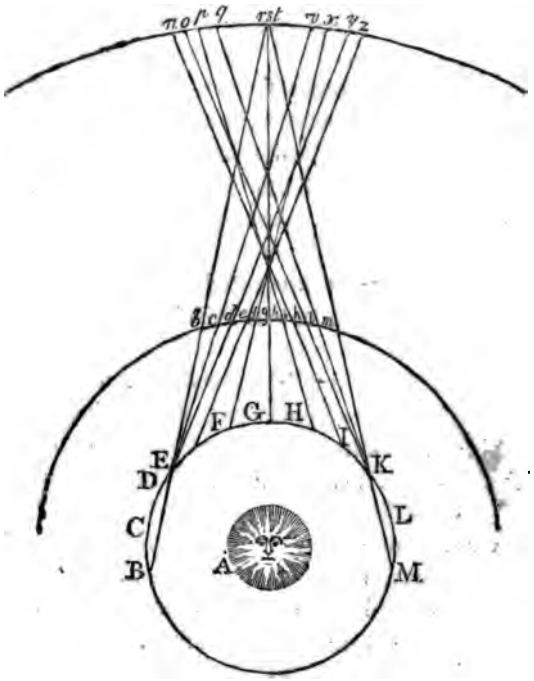
as much from him. The whole difference will amount to 47 degrees, which is the distance of one tropic from the other.

But now in the two other figures, when the earth is in either of the equinoctials ♈ ♎, the circle of illumination will pass through both the poles, and therefore must divide all the parallels into equal parts. From whence it will follow, that the day and night must then be equal in all places of the world.

As the earth is here represented in ♎, it turns only the enlightened part towards us: as it is in ♈ we see its nocturnal hemisphere.

So that according to this hypothesis, we may easily and exactly reconcile every appearance concerning the difference betwixt days and nights, winter and summer, together with all those other varieties which depend upon them.

If you would know how the planets (according to the system of the heavens) will appear direct, stationary, retrograde; and yet still move regularly about their own centres, you may plainly discern it by this following diagram.



Where suppose the sun to be at A, the circle (B, G, M) to be the orb of the earth's motion, and that above it noted with the same letters, to be the sphere of Jupiter; and the uppermost of all, to be a part of the zodiac in the starry heaven.

Now if you conceive the letters A B C D E F G H I K L M, and *b c d e f g h i k l m*, to divide the earth's orb and that of Jupiter, into several parts, proportionable to the slowness or swiftness of their different motions (Jupiter finishes his course in twelve years, and the earth in one) then supposing the earth to be at the point (B) and Jupiter likewise in his orb to be situated at (*b*,) he will appear unto us to be in the zodiac at the point (*r*.) But afterwards both of them moving forwards to the letter (C *c*) Jupiter will seem to be in the zodiac at (*v*,) as having passed di-

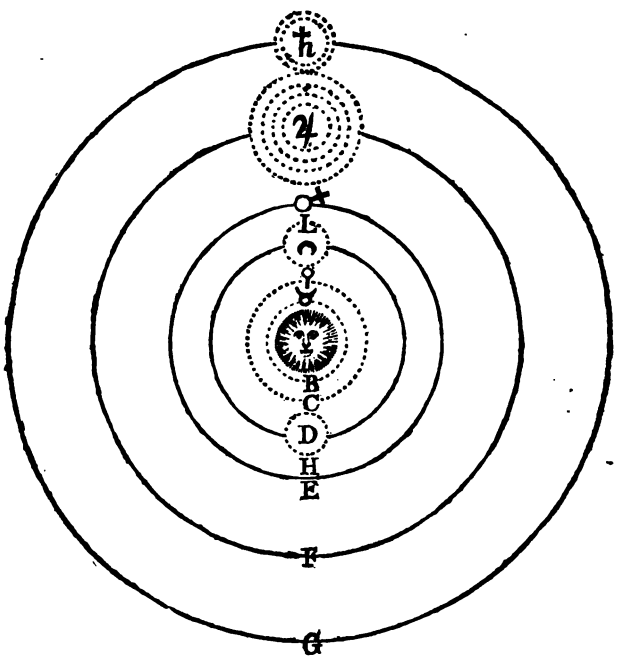
rectly forward according to the order of the signs. And so likewise each of them being transferred to the places (D *d*) (E *e*) Jupiter will still appear direct, and to have moved in the zodiac unto the points (*y z.*) But now when the earth comes to be more immediately interposed betwixt this planet and the sun; as when both of them are at the letter (F *f*) then will Jupiter be discerned in the zodiac at (*x.*) So that all the while the earth was passing the arch (E F) Jupiter did still remain betwixt the points (*z*) and (*x*,) and therefore must seem unto us as if he were stationary; but afterwards both of them being carried to (G *g*,) then Jupiter will appear at (*s*,) as if by a hasty motion he had returned from his former course the space (*x s.*) Both of them passing to (H *h*,) this planet will still seem to be swiftly retrograde, and appear in the point at (*p*,) but when they come to the points (I *i*,) Jupiter will then seem to be slower in this motion, and to have only passed the space (*p n.*) Both of them being transferred to (K *k*,) Jupiter will then appear in the zodiac at (*o*) as being again direct, going forward according to the order of the signs, and while the earth did pass the arch (I K) Jupiter then remained between the points (*n o*,) and so consequently did again seem to be stationary. Both of them coming to (L *l*,) and thence to (M *m*,) Jupiter will still appear direct, and to have gone forward in the zodiac from (*q*) to (*t.*) So that all the space wherein Jupiter is retrograde, is represented by the arch (*n z.*) In which space he himself moves in his own orb, the arch (*e i*,) and so the earth in its orb, a proportional space (E I).

As it hath been said of this planet, so likewise is it appliable to the other, Saturn, Mars, Venus, Mercury; all which are thus made to appear direct, stationary, and retrograde, by the motion of our earth, without the help of those epicycles and excentrics, and such unnecessary wheel-work, wherewith Ptolemy hath filled the heavens. Insomuch, that here Fromondus * is fain to confess, *nullo*

* Antarist. c. 18. Vest. tract. 4. c. 3.

argumento in speciem probabiliori, motum terræ annum a Copernicanis astrui, quam illo stationis, directionis, regressionis planetarum. There is not any more probable argument to prove the annual motion of the earth, than its agreeableness to the station, direction, and regression of the planets.

Lastly, that Copernicus's system of the heavens is very answerable to the exactest observations, may be manifest from this following description of it.



Suppose the sun to be situated at A: now because Mercury is found by experience to be always very near the sun, so that he does for the most part lie hid under his rays; as also because this planet hath a more lively vigorous light than any of the other; therefore we may infer, that his orb is placed next unto the sun, as that at B.

As for Venus, it is observed, that she does always keep

at a set distance from the sun, never going from him above 40 degrees, or thereabouts; that her body appears through the perspective to be forty times bigger at one time than at another; that when she seems biggest and nearest unto us, we then discern her as being perfectly round. Therefore doth this planet also move in a circle that encompasses the sun. Which circle does not contain the earth within it; because then Venus would sometimes be in opposition to the sun; whereas it is generally granted, that she never yet came so far as to be in a sextile.

Nor is this circle below the sun (as Ptolemy supposeth) because then this planet, in both its conjunctions, would appear horned, which she does not *.

Nor is it above the sun, because then she would always appear in the full, and never horned.

From whence it will follow, that this orb must necessarily be betwixt the earth and the sun, as that at C.

As for Mars, it is observed, that he does appear sixty times bigger when he is near us, than at his greatest distance; that he is sometimes in opposition to the sun. From whence we may conclude that his orb does contain our earth within it. It is observed also, that he does constantly appear in the full, and never horned: from whence likewise it is manifest, that the sun is comprehended within its orb, as it is in that which is represented by the circle E.

And because the like appearances are observed in Jupiter and Saturn (though in less degrees) therefore we may with good reason conceive them to be in the heavens, after some such manner as they are here set down in the figure, by the circles F G.

As for the moon, because she is sometimes in opposition to the sun, therefore must her orb comprehend in it the earth; because she appears dark in her conjunction, and sometimes eclipses the sun; therefore that must necessarily be without her orb, as it is in that epicycle at H. In the centre of which, the earth must necessarily be situated,

* Matutina Vespertina.

according to all those appearances mentioned before. So that the orb of its annual motion will be represented by the circle D.

All which appearances cannot so well be reconciled by Ptolemy, Tycho, Origanus, or by any other hypothesis, as by this of Copernicus. But the application of these to the several planets, together with sundry other particulars, concerning the theorical part of astronomy, you may see more fully set down by those who have purposely handled this subject, Copernicus, Rhetichus, Galilæus; but more especially Keplar: unto whom I do acknowledge myself indebted for sundry particulars in this discourse.

I have done with that which was the chief purpose of the present treatise; namely, the removal of those common prejudices that men usually entertain against this opinion. It remains, that by way of conclusion, I endeavour to stir up others unto these kind of studies, which by most men are so much neglected.

It is the most rational way, in the prosecution of several objects, to proportion our love and endeavour after every thing, according to the excellency and desirableness of it. But now amongst all earthly contentments, there is nothing either better in itself, or more convenient for us, than this kind of learning; and that, whether you consider it according to its general nature, as a science; or according to its more special nature, as such a science.

1. Consider it as a science. Certain it is, that amongst the variety of objects, those are more eligible which conduce unto the welfare of that which is our best part, our souls. It is not so much the pleasing of our senses, or the increasing of our fortunes, that does deserve our industry, as the information of our judgments, the improvement of our knowledge. Whatever the world may think, yet it is not a vast estate, a noble birth, an eminent place, that can add any thing to our true real worth; but it must be the degrees of that which makes us men, that must make us better men, the endowments of our soul, the enlargement of our reason. Were it not for the contemplation of philosophy,

the heathen Seneca* would not so much as thank the gods for his being: *nisi ad hæc admitterer non fuit opere pretium nasci. Detrahe hoc inestimabile bonum non est vita tanti, ut sudem, ut æstuem.* Take but away this benefit, and he would not think life worth the sweating for. So much happiness could he discern in the studies of nature. And therefore as a science in general, it may very well deserve our love and industry.

2. Consider it as such a particular science, astronomy: the word signifies the law of the stars; and the Hebrews (who do not ordinarily admit of composition) call it in two words, חקות שכים, *cælorum statuta*, or the ordinances of heaven †; because they are governed in their courses by a certain rule, as the Psalmist speaks in the cxlviiith Psal. ver. 6. God has given them a law which shall not be broken.

Now this of all other natural sciences may best of all challenge our industry; and that, whether you consider it,

1. Absolutely, as it is in itself: or,

2. As it stands in reference to us.

1. As it is in itself. The excellency of any science may be judged of (saith the philosopher) first, by the excellency of the object. Secondly, by the certainty of its demonstrations.

1. For the object. It is no less than the whole world (since our earth also is one of the planets) more especially those vast and glorious bodies of the heavens. So that in this respect it far exceeds all those barren, empty speculations about *materia prima*, and *universale*, and such like cobwebs of learning; in the study of which so many do misplace their younger years. And for the same reason likewise is it to be preferred before all those other sciences, whose subjects are not either of so wide an extent, or so excellent a nature.

2. For the demonstrations of astronomy, they are as infallible as truth itself; and for this reason also does it excel all other knowledge, which does more depend upon con-

* Præf. ad l. 1. Nat. Quest. † Job xxxviii. 33. Jer. xxxiii. 25.

jectures and uncertainty. They are only those who want skill in the principles of this science, that mistrust the conclusions of it. Since therefore in these respects, it is one of the most excellent sciences in nature, it may best deserve the industry of man, who is one of the best works of nature. Other creatures were made with their heads and eyes turned downwards: would you know why man was not created so too? why it was, that he might be an astronomer.

Os homini sublime dedit, celumque tueri
Jussit, et erectos ad sydera tollere vultus.

God gave to man an upright face, that he
Might view the stars, and learn astronomy.

2. Consider it in reference to us; and so it is,

1. Most useful.

2. Most pleasant.

1. Most useful, and that in sundry respects. It proves a God and a providence, and incites our hearts to a greater admiration and fear of his omnipotency. We may understand by the heavens, how much mightier he is that made them; for by the greatness and beauty of the creatures, proportionably the maker of them is seen, saith the book of Wisdom, xiii. 4, 5. It was hence that Aristotle did fetch his chief argument to prove a *primus motor*. It was the consideration of these things that first led men to the knowledge and worship of God (saith Tully*) *hæc nos primum ad deorum cultum, tum ad modestiam, magnitudinemque animi erudivit.* And therefore when God by the prophet would convince the people of his deity, he bids them lift up their eyes on high, and behold who hath created those things; that bringeth out their host by number, that calleth them all by their names, &c. Isa. xl. 26. which occasioned that saying of Lactantius†; *Tanta rerum magnitudo, tanta dispositio, tanta in servandis ordinibus, temporibusque constantia; non potuit aut olim sine provido artifice oriri,*

* Tuscul. 1. item Plut. de Placit. Phil. l. 1. c. 6..

† Instit. l. 2. c. 5.

aut constare tot sæculis sine incola potente, aut perpetuum gubernari sine perito et sciente rectore, quod ratio ipsa declarat. Such a great order and constancy amongst those vast bodies, could not at first be made but by a wise providence, nor since preserved without a powerful inhatant, nor so perpetually governed without a skilful guide.

True indeed, an ordinary view and common apprehension of these celestial bodies, must needs manifest the excellency and omnipotency of their maker; but yet a more accurate and diligent enquiry into their natures, will raise our understandings unto a nearer knowledge, and a greater admiration of the deity: as it is in those inferior things, where the meer outside of a man, the comeliness and majesty of his countenance, may be some argument from whence to infer the excellency of his creator. But yet the subtle anatomist, who searches more deeply into this wonderful structure, may see a clear evidence for this in the consideration of the inward fabric, the muscles, nerves, membranes, together with all those secret contrivances in the frame of this little world. Thus also is it in the great universe, where the common apprehension of things is not at all considerable, in comparison to those other discoveries, which may be found out by a more exact enquiry.

As this knowledge may conduce to the proving of a God, and making men religious; so likewise may it serve to confirm unto us the truth of the holy scriptures: since the sacred story, in the order of its narrations, does so exactly agree with the conversions of heaven, and logistical astronomy.

It may also stir us up to behave ourselves answerably unto the noble and divine nature of our souls. When I consider the heaven, the works of thy fingers, the moon and the stars which thou hast ordained, what is man, that thou art so mindful of him *? as to create such vast glorious bodies for his service.

Again, when I consider with myself the strange immen-

* Psal. viii. 3. 6.

sity and bigness of this great universe, in comparison to which, this earth of ours is but as an undiscernible point: when I consider that I carry a soul about me, of far greater worth than all this, and desires that are of a wider extent, and more unbounded capacity than this whole frame of nature; then, methinks, it must needs argue a degenerateness and poverty of spirit, to busy my faculties about so ignoble, narrow a subject as any of these earthly things. What a folly is it in men to have such high conceits of themselves, for some small possessions which they have in the world above others; to keep so great a bustle about so poor a matter? *Hoc est punctum quod inter tot gentes ferro et igni dividitur**. It is but a little point which with so much ado is distributed unto so many nations by fire and sword. What great matter is it to be monarch of a small part of a point? Might not the ants as well divide a little mole-hill into divers provinces, and keep as great a stir in disposing of their government? *punctum est illud in quo navigatis, in quo bellatis, in quo regna desponitis.* All this place wherein we war, and travel, and dispose of kingdoms, is but a point far less than any of those small stars, that at this distance are scarce discernible. Which when the soul does seriously meditate upon, it will begin to despise the narrowness of its present habitation, and think of providing for itself a mansion in those wider spaces above; such as may be more agreeable to the nobleness and divinity of its nature.

Why should any one dream of propagating his name, or spreading his report through the world? When although he had more glory than ambition can hope for, yet as long as all this habitable earth is but an inconsiderable point, what great matter can there be in that fame which is included within such strait contracted limits?

Quicunque solam mente præcipiti petit
Summumque credit gloriam,

* Sen. Nat. Quæst. l. 1. Nonne ô terrena animalia consideratis, quibus præsidere videamini? Nam si inter mares videres unum aliquam, jus sibi ac potestatem præ cæteris vindicentem, quanto movereris cachinno, &c. Boetius de Consol. l. 2.

Late patentes ætheris cernat plagas,
Arctumque terrarum situm.
Brevem replere non valentis ambitum,
Pudebit aucti nominis *.

" He that to honour only seeks to mount,
" And that his chiefest end doth count;
" Let him behold the largeness of the skies,
" And on the strait earth cast his eyes;
" He will despise the glory of his name,
" Which cannot fill so small a frame."

Why should any one be taken up in the admiration of these lower outsides, these earthly glories? *Respicite cæli spatium, firmitudinem, celeritatem, et aliquando definite vilia mirari*†. He that rightly understands the nature of the heavens, will scarce esteem any other thing worth his notice, much less his wonder.

Now when we lay all this together, that he who hath most in the world, hath almost nothing of it: that the earth itself, in comparison to the universe is but an inconsiderable point; and yet that this whole universe does not bear so great a proportion to the soul of man, as the earth does unto that. I say, when a man in some retired thoughts shall lay all this together, it must needs stir up his spirits to a contempt of these earthly things, and make him place his love and endeavour upon those comforts that may be more answerable to the excellency of his nature.

Without this science, what traffic could we have with foreign nations? What would become of that mutual commerce, whereby the world is now made but as one commonwealth.

Vosque mediis in aquis stellæ, pelagoque timendo.
Decretum monstrastis iter, totique dedistis,
Legibus inventis hominum, commercia mundo.

'Tis you bright stars, that in the fearful sea,
Do guide the pilot through his purposed way.
'Tis your direction that doth commerce give,
With all those men that through the world do live.

* Boetius de Consol. l. 2. † Idem, lib. 3.

2. As this science is thus profitable in these and many other respects; so likewise is it equally pleasant. The eye (saith the philosopher) is the sense of pleasure, and there are no delights so pure and immaterial as those which enter through that organ. Now to the understanding, which is the eye of the soul, there cannot be any fairer prospect, than to view the whole frame of nature, the fabric of this great universe, to discern that order and comeliness which there is in the magnitude, situation, motion of the several parts that belong unto it; to see the true cause of that constant variety and alteration which there is in the different seasons of the year*. All which must needs enter into a man's thoughts with a great deal of sweetness and complacency. And therefore it was that Julius Cæsar in the broils and tumult of the camp, make choice of this delight:

> ——— *Media inter prælia semper,*
> *Stellarum, cæliquæ plagis, superisque vacavit.* †
>
> He always leisure found amidst his wars,
> To mark the coast of heaven, and learn the stars.

And for this reason likewise did Seneca, amidst the continual noise and bustle of the court, betake himself to this recreation.

> *O quam juvabat, quo nihil majus, parens*
> *Natura genuit, operis immensi artifex,*
> *Cælum intueri solis, et currus sacros*
> *Mundique motus, solis alternas vices,*
> *Orbemque Phœbes, astra quem cingunt vaga*
> *Lateque fulgens ætheris magni decus.*
>
> O what a pleasure was it to survey
> Nature's chief work, the heavens; where we may
> View the alternate courses of the sun,
> The sacred chariots, how the world doth run:
> The moon's bright orb, when she's attended by
> Those scattered stars, whose light adorns the sky.

And certainly those eminent men who have this way bestowed a great part of their employment, such as were

* Wis. vii. 18, 19. † Lucan, l. 10.

Ptolomy, Julius Cæsar, Alphonsus king of Spain, the noble Tycho, &c. have not only by this means pitched upon that which for the present was a more solid kind of pleasure and contentment; but also a surer way to propagate their memories unto future ages Those great costly pyramids which were built to perpetuate the memory of their founders, shall sooner perish and moulder away into their primitive dust, than the names of such worthies shall be forgotten. The monuments of learning are more durable than the monuments of wealth or power.

All which encouragements may be abundantly enough to stir any considering man, to bestow some part of his time in the study and inquisition of these truths.

Fœlices animæ, quibus hæc cognoscere primum,
Inque domos superas scandere cura fuit.

END OF VOL. I.

C. Whittingham, *Printer*,
Dean-Street, Fetter-Lane, London.